



United States
Department of
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Soil
Conservation
Service

In cooperation with
Washington State
Department of Natural
Resources; United States
Department of
Agriculture, Forest
Service; and Washington
State University
Agricultural Research
Center

Soil Survey of Snoqualmie Pass Area, Parts of King and Pierce Counties, Washington



How To Use This Soil Survey

General Soil Map

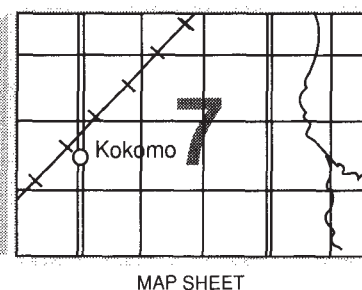
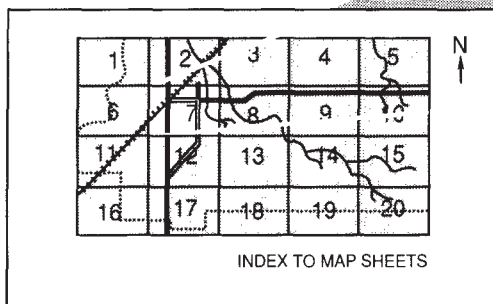
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

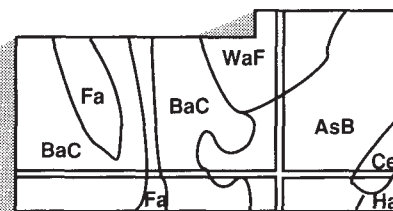
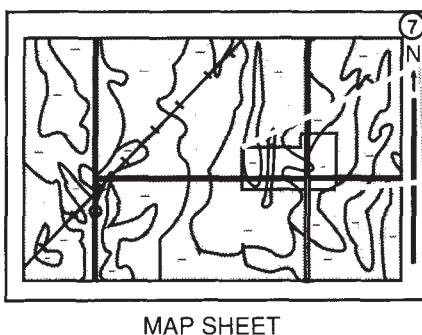
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in July 1980. Soil names and descriptions were approved in April 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980. This survey was made cooperatively by the Soil Conservation Service; the Washington State Department of Natural Resources; United States Department of Agriculture, Forest Service; and Washington State University Agricultural Research Center. It is part of the technical assistance furnished to the conservation districts of King and Pierce Counties.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: A wooded area in the valley of the South Fork of the Snoqualmie River.

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<i>Depth. USDA texture. Classification—Unified, AASHTO. Fragments greater than 3 inches. Fragments 3-10 inches. Percentage passing sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.</i>	
Physical and chemical properties of the soils (table 15)	565
<i>Depth. Clay. Moist bulk density. Permeability. Available water capacity. Soil reaction. Shrink-swell potential. Erosion factors. Organic matter.</i>	
Water features (table 16)	582
<i>Hydrologic group. Flooding. High water table.</i>	
Soil features (table 17)	591
<i>Bedrock. Cemented pan. Subsidence. Potential frost action. Risk of corrosion.</i>	
Classification of the soils (table 18)	600
<i>Family or higher taxonomic class.</i>	

Foreword

This soil survey contains information that can be used in land-planning programs in the survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



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Soil Survey of Snoqualmie Pass Area, Parts of King and Pierce Counties, Washington

By Alan Goldin, Soil Conservation Service

Fieldwork by James A. Mitchell, Steven B. Campbell, and Charles S. Natushara, Soil Conservation Service, and John A. Fisher and Carla Culver, Washington State Department of Natural Resources

Woodland fieldwork by William J. Westberg, forestry consultant

United States Department of Agriculture, Soil Conservation Service, in cooperation with Washington State Department of Natural Resources; United States Department of Agriculture, Forest Service; and Washington State University Agricultural Research Center

The survey area is in the west-central part of Washington (fig. 1). It is bounded by Snohomish County on the north, Lewis County on the south, and Mount Rainier National Park on the southeast. It makes up the eastern part of King and Pierce Counties. It has a total area of 1,187,130 acres, or about 1,855 square miles.

Two older surveys, "Soil Survey of King County Area, Washington" and "Soil Survey of Pierce County Area, Washington," were published in 1973 and 1979, respectively (26, 36). These earlier surveys cover a very small part of the present survey. Four other older surveys have been completed for parts of the survey area: "Soil Resource Inventory—Snoqualmie National Forest," published in 1972 (27); "Soil Survey of the Snoqualmie Falls Tree Farm," published in 1961 (16); "Soil Survey of the White River Tree Farm," published in 1973 (13); and "Soil Survey of the Snoqualmie Falls Tree Farm," published in 1974 (32). The present survey updates these earlier surveys. It provides additional information and has larger maps, which show the soils in greater detail.

General Nature of the Survey Area

This section gives general information about the survey area. It describes history and development; physiology, relief, and drainage; and climate.

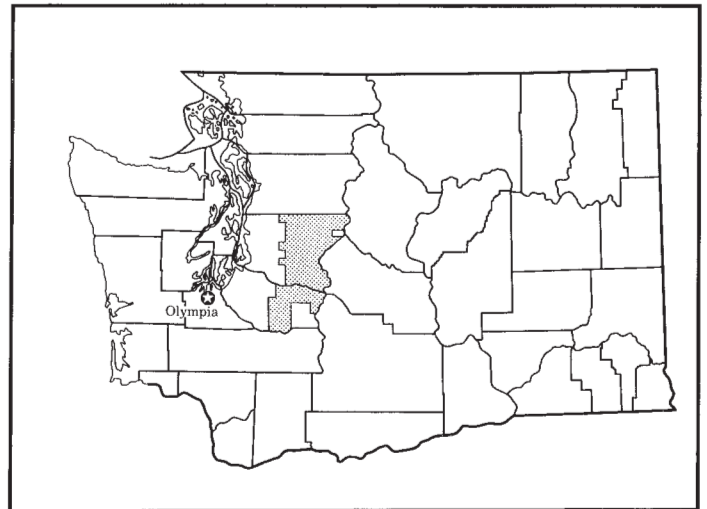


Figure 1.—Location of Snoqualmie Pass area in Washington.

History and Development

The modern history of this survey area begins in the 1830's. At this time explorers from the Hudson's Bay Company traveled through Naches Pass, establishing a link between the forts on the east and west sides of the Cascade Mountains. In 1854, the President and the

Secretary of War authorized railroad surveys, which began an extensive exploration of the Cascades.

Miners probably reached the area as early as the 1860's. For a while they came by the hundreds, but the "rush" was short lived. Mining for coal began in the Carbon River area in 1862, mining for iron ore in the Snoqualmie River Valley near North Bend in 1869, and mining for iron and copper in the Cedar River area in 1891. Mining continues to be a significant industry in the survey area.

Logging started in the valley of the Skykomish River in about 1860, in the valley of the Snoqualmie River in 1872, in the valley of the Green River in 1880, in the valley of the White River in 1896, and along the Carbon River in 1912. As logging progressed and new logging methods were introduced, mills were established throughout the area.

The Federal Government gave railroad companies vast quantities of land to finance construction across the continent. In 1888, the Northern Pacific railroad built a line through the mountains at Stampede Pass. In 1915, the Chicago, Milwaukee, and St. Paul Railroad completed construction of a tunnel through Snoqualmie Pass. Subsequent lines and spurs further opened the Cascades.

Water is a valuable resource in the survey area. In 1898, Seattle acquired the water rights for the Cedar River watershed. In 1910, Tacoma constructed a gravity water-supply system from the Green River watershed.

Recreational sites are an important resource in the survey area. Skiing, hiking, climbing, camping, hunting, fishing, and berry picking are among the numerous recreational activities. The first ski lodge in Snoqualmie Pass was constructed in 1913.

In 1891, Congress passed the General Land Law Revision Act, which included a provision authorizing the President to withdraw forest reserves from the unreserved public domain. This law led to the formation of the Snoqualmie National Forest in 1908. In 1973, Mt. Baker National Forest was merged with Snoqualmie National Forest, forming Mt. Baker-Snoqualmie National Forest (18).

Physiography, Relief, and Drainage

Russell F. Pringle, Soil Conservation Service, assisted in writing this section.

This survey area extends from the crest of the Cascade Mountain Range west to the Puget Sound lowlands. The uplands in the eastern part of the survey area have rugged mountains and alpine topography that were modified by glacial activity and are drained by rivers that generally flow to the west. The landscape is characterized by long, steep slopes and relatively

straight, parallel drainageways. The average elevation of the ridgetops ranges from 5,000 to 6,000 feet. Crystal Mountain has the highest elevation, about 7,800 feet.

The survey area has six large drainage systems, including the headwaters of the Cedar, Green, Nisqually, Puyallup, Skykomish, and Snoqualmie Rivers. These rivers have very similar topography. They originate in mountain areas and flow into the Puget Sound lowlands.

The Cedar River originates in the Yakima Pass area of the Cascade Mountain Crest, flows in a northwesterly direction, and empties into Lake Washington near Renton.

The Green River originates in the Cascade Mountains, flows in a northwesterly direction to Chester Morse Lake, and empties into Puget Sound near Seattle. Chester Morse Lake is part of the water supply for Seattle.

The Nisqually River forms part of the southern boundary of the survey area. It originates on the Nisqually glacier, flows in a westerly direction, and empties into Puget Sound between the cities of Olympia and Tacoma. The Nisqually glacier is on the flanks of Mount Rainier.

The Puyallup River originates on the Puyallup and Tacoma glaciers on the slopes of Mount Rainier. It flows into Puget Sound near Tacoma.

The Skykomish River originates in the Stevens Pass area, flows into Snohomish County, and empties into Puget Sound near Everett.

The Snoqualmie River originates in the Cascade Mountains north of Snoqualmie Pass. It flows in a northwesterly direction and forms part of the western boundary of the survey area. It flows in a northerly direction into Snohomish County, where it merges with the Skykomish River.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

The climate of the Snoqualmie Pass area is greatly tempered by winds from the Pacific Ocean. Summers are fairly warm, but hot days are rare. Winters are cool, but snow and freezing temperatures are common only at the higher elevations. At the lower elevations freezing temperatures commonly occur under the influence of dry air masses. In summer rainfall is extremely light. Irrigation is needed if crops are grown during the summer. Several consecutive weeks without precipitation are common. During the rest of the year, rains are frequent, especially in late fall and winter.

In most winters one or two storms are accompanied

by strong and sometimes damaging winds, and in some years the accompanying heavy rains cause serious flooding. In some years, either during winter or summer, a large invasion of a continental air mass from the east causes abnormal temperatures. As a result, several consecutive days are well below freezing in winter or a week or longer is sweltering in summer.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Baring in the period 1970 to 1978, Electron Headworks in the period 1951 to 1978, and Snoqualmie Pass in the period 1952 to 1970. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperatures at Baring, Electron Headworks, and Snoqualmie Pass are 36, 35, and 29 degrees F, respectively. The average daily minimum temperature is 31 degrees at Baring, 30 degrees at Electron Headworks, and 24 degrees at Snoqualmie Pass. The lowest temperature on record, which occurred at Snoqualmie Pass on December 39, 1968, is -19 degrees. In summer the average temperature is 61 degrees at Baring, 59 degrees at Electron Headworks, and 56 degrees at Snoqualmie Pass. The average daily maximum temperature is about 70. The highest recorded temperature, which occurred at Electron Headworks on August 17, 1977, is 100 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 114 inches at Baring, 64 inches at Electron Headworks, and 105 inches at Snoqualmie Pass. About 25 to 30 percent of the total usually falls in April through September, which includes the growing season for most crops. The heaviest 1-day rainfall during the period of record was 7.38 inches at Baring on February 27, 1972. Thunderstorms occur on about 10 days each year.

The average seasonal snowfall is about 61 inches at Baring, 48 inches at Electron Headworks, and 514 inches at Snoqualmie Pass. The greatest snow depth at any one time during the period of record was 32 inches at Baring, 14 inches at Electron Headworks, and 225 inches at Snoqualmie Pass. On the average, 58 days at Baring, 38 days at Electron Headworks, and 75 days at Snoqualmie Pass have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 25 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 13 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining

their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists.

For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this soil survey do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general map units in this survey have been grouped into general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

Map Unit Descriptions

Soils on High Mountains

These soils make up about 44 percent of the survey area. They are nearly level to very steep. The native vegetation is mainly conifers and shrubs. Elevation is 2,200 to 6,000 feet. The average annual precipitation is 70 to 130 inches, and the average annual air temperature is 37 to 42 degrees F. The average frost-free period is 70 to 130 days.

These soils are moderately deep, deep, and very deep and are excessively drained, moderately well drained, and well drained. They formed in pumice and volcanic ash over residuum and colluvium derived from extrusive igneous rocks, andesite, tuff, breccia, or glacial till and in a mixture of organic material, volcanic ash, and pumice.

These soils are used mainly for woodland, recreational areas, and wildlife habitat.

1. Ethania-Cattcreek

Very deep, well drained, gently sloping to very steep soils on mountain ridge crests and back slopes and in cirque basins

This map unit is in the southeastern part of the survey area, along the west boundary of Mount Rainier National Park. Slopes are 8 to 90 percent. The vegetation is trees and shrubs. Elevation is 2,800 to 5,300 feet. The average annual precipitation is 80 to 115 inches, and the average annual air temperature is 37 to 39 degrees F. The average frost-free period is 90 to 120 days.

This unit makes up about 4 percent of the survey area. It is about 40 percent Ethania soils, 35 percent Cattcreek soils, and 25 percent soils of minor extent.

Ethania soils formed in dacitic pumice and volcanic ash over residuum and colluvium derived from sandstone, andesite, and glacial till. Typically, the surface layer is very cindery loamy sand. The subsoil is very cindery loamy sand, very gravelly loam, and very gravelly sandy loam. The substratum is extremely cobbly loamy sand.

Cattcreek soils formed in dacitic pumice and volcanic ash over residuum and colluvium derived from andesite. Typically, the surface layer is very cindery loamy sand. The subsoil is very cindery loamy sand and very cindery sand. The substratum is very gravelly sandy loam.

Of minor extent in this unit are Cotteral and Vailton soils and Rock outcrop.

This unit is used for woodland, recreational areas, and wildlife habitat. The main limitation in the areas used for woodland is snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

2. Nimue-Haywire-Chinkmin

Moderately deep and very deep, well drained and moderately well drained, nearly level to very steep soils on ridgetops, mountainsides, and mountain back slopes,

in cirque basins and valleys, and on lateral moraines and drift plains

This map unit is in the southern part of the survey area, along the north boundary of Mount Rainier National Park. Slopes are 6 to 90 percent. The vegetation is trees and shrubs. Elevation is 2,500 to 6,000 feet. The average annual precipitation is 70 to 120 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is 70 to 120 days.

This unit makes up about 11 percent of the survey area. It is about 38 percent Nimue soils, 30 percent Haywire soils, 16 percent Chinkmin soils, and 16 percent soils of minor extent.

Nimue soils are on ridgetops and mountainsides. They are very deep and well drained. They formed in a thin mantle of loess and pumice over residuum and colluvium derived from extrusive igneous rocks or from breccia and tuff. Typically, the surface layer is loamy sand. The subsoil is sandy loam and very gravelly loam. The substratum is extremely gravelly silt loam.

Haywire soils are on ridgetops and mountain back slopes. They are moderately deep and well drained. They formed in volcanic ash and pumice over residuum and colluvium derived from extrusive igneous rocks or from tuff and breccia. Typically, the surface layer is sandy loam. The subsoil is loam, gravelly loam, very cobbly loam, and extremely cobbly loam. Andesite is at a depth of 20 to 40 inches.

Chinkmin soils are in cirque basins and valleys or on lateral moraines and drift plains. They are moderately deep to orstein and are moderately well drained. They formed in a thin mantle of volcanic ash or pumice over colluvium derived from dense glacial till. Typically, the surface layer is sandy loam. The subsoil is gravelly and very cobbly loam. The substratum is very gravelly sandy loam. Dense glacial till is at a depth of 20 to 40 inches.

Of minor extent in this unit are Cayuse, Foss, Nagrom, Playco, and Serene soils and Rock outcrop.

This unit is used for woodland, recreational areas, and wildlife habitat. The main limitation in the areas used for woodland is snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

3. Reggad-Altapeak-Index

Deep and very deep, well drained and excessively drained, gently sloping to very steep soils on mountain slopes and back slopes

This map unit is in the northeastern part of the survey area. Slopes are 8 to 90 percent. The vegetation

is trees and shrubs. Elevation is 2,200 to 6,000 feet. The average annual precipitation is 75 to 130 inches, and the average annual air temperature is 40 to 42 degrees F. The average frost-free period is 90 to 130 days.

This unit makes up about 8 percent of the survey area. It is about 37 percent Reggad soils, 23 percent Altapeak soils, 20 percent Index soils, and 20 percent soils of minor extent.

Reggad soils are on mountain back slopes. They are very deep and excessively drained. They formed in a mixture of organic material, volcanic ash, and pumice over rock rubble. Typically, the surface layer is very cobbly muck and very cobbly loam. The underlying material is angular rock fragments.

Altapeak soils are on mountain slopes. They are deep and well drained. They formed in volcanic ash and pumice mixed with residuum and colluvium over granitic and metamorphic rocks. Typically, the surface layer is gravelly sandy loam. The subsoil is very gravelly sandy loam. The substratum is extremely cobbly loamy sand and extremely gravelly coarse sand. Weathered granodiorite is at a depth of 40 to 60 inches.

Index soils are on mountain back slopes. They are deep and well drained. They formed in volcanic ash and pumice mixed with colluvium derived from granitic and low-grade metamorphic rocks. Typically, the surface layer is loamy sand. The subsoil is very cobbly and very gravelly loamy sand. The substratum is extremely cobbly sand. Weathered granodiorite is at a depth of 40 to 60 inches.

Of minor extent in this unit are Klapatche, Playco, Reichel, Serene, and Treen soils; Rubble land; and Rock outcrop.

Altapeak and Index soils are used for woodland, recreational areas, and wildlife habitat. Reggad soils are used for wildlife habitat. The main limitation in the areas used for woodland is snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

4. Nimue

Very deep, well drained, gently sloping to very steep soils on ridgetops and mountain back slopes

This map unit is in the southeastern part of the survey area. Slopes are 6 to 90 percent. The vegetation is trees and shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is 70 to 120 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is 110 to 130 days.

This unit makes up about 5 percent of the survey

area. It is about 72 percent Nimue soils and 28 percent soils of minor extent.

Nimue soils formed in a thin mantle of volcanic ash and pumice and in residuum and colluvium derived from extrusive igneous rocks or from breccia and tuff. Typically, the surface layer is loamy sand. The subsoil is sandy loam and very gravelly loam. The substratum is extremely gravelly silt loam.

Of minor extent in this unit are Foss, Haywire, and Playco soils.

This unit is used for woodland, recreational areas, and wildlife habitat. The main limitation in the areas used for woodland is snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

5. Playco-Nagrom

Moderately deep and very deep, well drained, gently sloping to very steep soils on ridge crests and mountain back slopes

This map unit is throughout the survey area. Slopes are 5 to 90 percent. The vegetation is trees and shrubs. Elevation is 2,400 to 3,600 feet. The average annual precipitation is 75 to 100 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is 110 to 130 days.

This unit makes up about 11 percent of the survey area. It is about 43 percent Playco soils, 29 percent Nagrom soils, and 28 percent soils of minor extent.

Playco soils are on mountain back slopes. They are very deep. They formed in volcanic ash and pumice mixed with colluvium derived from andesite, breccia, and tuff. Typically, the surface layer is very gravelly loamy sand. The subsoil is very gravelly loamy sand and extremely gravelly sandy loam. The substratum is extremely gravelly sandy loam.

Nagrom soils are on ridge crests and mountain back slopes. They are moderately deep. They formed in volcanic ash and pumice over residuum and colluvium derived from extrusive igneous rocks or breccia and tuff. Typically, the surface layer is sandy loam. The subsoil is loam and gravelly loam. The substratum is very gravelly loam. Fractured andesite is at a depth of 20 to 40 inches.

Of minor extent in this unit are Andic Cryumbrepts; Gallup, Getchell, Hartnit, Kindy, Nimue, Reichel, and Stahl soils; and Rock outcrop.

This unit is used for woodland, recreational areas, and wildlife habitat. In the areas used for woodland, the main limitation is snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

6. Playco

Very deep, well drained, gently sloping to very steep soils on mountain back slopes

This map unit is in the central part of the survey area. Slopes are 5 to 90 percent. The vegetation is trees and shrubs. Elevation is 2,500 to 3,600 feet. The average annual precipitation is 75 to 90 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is 110 to 130 days.

This unit makes up about 5 percent of the survey area. It is about 80 percent Playco soils and 20 percent soils of minor extent.

Playco soils formed in volcanic ash and pumice mixed with colluvium derived from andesite, breccia, and tuff. Typically, the surface layer is very gravelly loamy sand. The subsoil is very gravelly loamy sand and extremely gravelly sandy loam. The substratum is extremely gravelly sandy loam.

Of minor extent in this unit are Nagrom, Nimue, Reichel, Spukwush, and Stahl soils and Rock outcrop.

This unit is used for woodland, recreational areas, and wildlife habitat. In the areas used for woodland, the main limitation is snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

Soils on Low Mountains

These soils make up about 31 percent of the survey area. They are nearly level to very steep. The native vegetation is mainly conifers and shrubs. Elevation is 1,400 to 2,800 feet. The average annual precipitation is 55 to 140 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is 110 to 180 days.

These soils are moderately deep, deep, and very deep and are moderately well drained and well drained. They formed in volcanic ash and volcanic ash and loess over colluvium, glacial till over glacial drift, dense glacial till, cemented glacial till, and residuum and colluvium derived from igneous rock, tuff and breccia, and metamorphic rocks.

These soils are used mainly for woodland, recreational areas, and wildlife habitat.

7. Zynbar

Deep and very deep, well drained, nearly level to very steep soils on mountain back slopes

This map unit is in the southwestern part of the survey area. Slopes are 0 to 65 percent. The vegetation is trees and shrubs. Elevation is 1,500 to 2,800 feet. The average annual precipitation is 70 to 100 inches,

and the average annual air temperature is about 44 degrees F. The average frost-free period is 140 to 160 days.

This unit makes up about 3 percent of the survey area. It is about 71 percent Zynbar soils and 29 percent soils of minor extent.

Zynbar soils formed in a mixture of volcanic ash, colluvium derived from basic igneous rocks, and glacial till over glacial drift. Typically, the surface layer is loam. The subsoil is gravelly silt loam. The substratum is silt loam.

Of minor extent in this unit are Bellicum, Cinebar, Jonas, Larrupin, Pitcher, and Vailton soils.

This unit is used for woodland, recreational areas, and wildlife habitat. In the areas used for woodland, the main limitation is occasional snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

8. Pitcher-Jonas-Oakes

Deep and very deep, well drained, gently sloping to very steep soils on mountain back slopes and toe slopes

This map unit is in the central and south part of the survey area. Slopes are 6 to 90 percent. The vegetation is trees and shrubs. Elevation is 1,400 to 2,800 feet. The average annual precipitation is 55 to 90 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is 120 to 180 days.

This unit makes up about 8 percent of the survey area. It is about 38 percent Pitcher soils, 24 percent Jonas soils, 15 percent Oakes soils, and 23 percent soils of minor extent.

Pitcher soils are on mountain back slopes. They are very deep. They formed in volcanic ash over colluvium and residuum derived from andesite or breccia and tuff. Typically, the surface layer is sandy loam. The underlying material is very gravelly loam.

Jonas soils are on mountain back slopes. They are deep and very deep. They formed in colluvium and residuum derived from andesite or tuff and breccia. The colluvium and residuum have an admixture of volcanic ash. Typically, the surface layer is gravelly loam. The subsoil also is gravelly loam. The substratum is very gravelly loam. Weathered tuff is at a depth of 40 to 60 inches.

Oakes soils are on mountain back slopes and toe slopes. They are very deep. They formed in a mixture of volcanic ash and colluvium and slope alluvium derived from glacial drift. Typically, the surface layer is gravelly loam. The subsoil is very gravelly loam. The substratum is very gravelly sandy loam.

Of minor extent in this unit are Bellicum, Bromo,

Dobbs, Littlejohn, Olomount, Pheeney, and Voight soils and Rock outcrop.

This unit is used for woodland, recreational areas, and wildlife habitat. The main limitation in the areas used for woodland is occasional snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

9. Kaleetan-Melakwa

Moderately deep and very deep, well drained, gently sloping to very steep soils on mountain back slopes and toe slopes

This map unit is in the northern and central part of the survey area. Slopes are 8 to 90 percent. The vegetation is trees and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 90 to 130 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is 135 to 155 days.

This unit makes up about 7 percent of the survey area. It is about 61 percent Kaleetan soils, 13 percent Melakwa soils, and 26 percent soils of minor extent.

Kaleetan soils are on glacially modified mountain back slopes and toe slopes. They are very deep. They formed in a mixture of volcanic ash and pumice over colluvium derived from andesite, tuff, breccia, and glacial till. Typically, the surface layer is sandy loam. The subsoil is very gravelly and gravelly sandy loam. The substratum is very gravelly and extremely gravelly sandy loam.

Melakwa soils are on glacially modified mountain back slopes and toe slopes. They are moderately deep. They formed in a mixture of volcanic ash and pumice over colluvium derived from andesite or breccia. Typically, the surface layer is sandy loam. The subsoil is very gravelly sandy loam and very gravelly loam. The substratum is extremely gravelly loam. Hard, fractured andesite is at a depth of 20 to 40 inches.

Of minor extent in this unit are Littlejohn, Marblemount, and Philippa soils.

This unit is used for woodland, recreational areas, and wildlife habitat. In the areas used for woodland, the main limitation is occasional snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

10. Tenerife-Marblemount

Moderately deep to very deep, well drained, gently sloping to very steep soils on mountain back slopes

This map unit is in the northeastern part of the survey area. Slopes are 8 to 90 percent. The vegetation is trees and shrubs. Elevation is 1,600 to 2,800 feet.

The average annual precipitation is 70 to 130 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is 110 to 155 days.

This unit makes up about 3 percent of the survey area. It is about 45 percent Teneriffe soils, 24 percent Marblemount soils, and 31 percent soils of minor extent.

Teneriffe soils are on mountain back slopes. They are deep and very deep. They formed in volcanic ash and pumice over colluvium derived from granitic and low-grade metamorphic rocks. Typically, the surface layer is loamy sand. The subsoil is loamy sand, gravelly loamy sand, and very gravelly loamy sand. The substratum is very gravelly coarse sand.

Marblemount soils are on glacially modified mountain back slopes. They are moderately deep. They formed in a mixture of volcanic ash, glacial till, and colluvium derived from granite and low-grade metamorphic rocks. Typically, the surface layer is gravelly loamy sand. The subsoil is very gravelly and extremely gravelly loamy sand. Fractured granite is at a depth of 20 to 40 inches.

Of minor extent in this unit are Philippa soils and Rock outcrop. Philippa soils formed in volcanic ash, colluvium, and glacial till.

This unit is used for woodland, recreational areas, and wildlife habitat. In the areas used for woodland, the main limitation is occasional snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

11. Elwell-Philippa

Moderately deep, moderately well drained, nearly level to very steep soils on mountain back slopes, on plateaus, in cirques, and on lateral moraines

This map unit is in the central part of the survey area. Slopes are 0 to 65 percent. The vegetation is trees and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 60 to 140 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is 130 to 170 days.

This unit makes up about 4 percent of the survey area. It is about 49 percent Elwell soils, 25 percent Philippa soils, and 26 percent soils of minor extent.

Elwell soils are on mountain back slopes and plateaus. They formed in glacial till that has an admixture of volcanic ash and loess. Typically, the surface layer is silt loam. The subsoil is silt loam and gravelly silt loam. Glacial till is at a depth of 20 to 40 inches.

Philippa soils are in cirques and on lateral moraines. They formed in a mixture of volcanic ash, colluvium, and ablation till over dense glacial till. Typically, the surface layer is sandy loam. The subsoil is gravelly silt

loam and very gravelly sandy loam. Ortstein is at a depth of 20 to 40 inches.

Of minor extent in this unit are Blethen, Kaleetan, Marblemount, Melakwa, Skykomish, Teneriffe, and Welcome soils and Rock outcrop.

This unit is used for woodland, recreational areas, and wildlife habitat. In the areas used for woodland, the main limitation is occasional snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

12. Pitcher

Very deep, well drained, gently sloping to very steep soils on mountain back slopes

This map unit is in the central part of the survey area. Slopes are 8 to 65 percent. The vegetation is trees and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 55 to 80 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is 135 to 155 days.

This unit makes up about 6 percent of the survey area. It is about 55 percent Pitcher soils and 45 percent soils of minor extent.

Pitcher soils formed in volcanic ash over colluvium and residuum derived from andesite or breccia and tuff. Typically, the surface layer is sandy loam. The subsoil is gravelly sandy loam and very gravelly loam. The substratum is extremely gravelly sandy loam.

Of minor extent in this unit are Jonas, Kaleetan, Littlejohn, Olomount, and Pheaney soils.

This unit is used for woodland, recreational areas, and wildlife habitat. In the areas used for woodland, the main limitation is occasional snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

Soils on Terraces, Foothills, and Till Plains

These soils make up about 24 percent of the survey area. They are nearly level to very steep. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is 40 to 100 inches, and the average annual air temperature is 45 to 50 degrees F. The average frost-free period is 120 to 200 days.

These soils are moderately deep and very deep and are somewhat excessively drained, moderately well drained, well drained, and somewhat poorly drained. They formed in alluvium, colluvium, back slope alluvium derived from glacial drift, material weathered from andesite and breccia, volcanic ash, pumice, glacial till, and glacial outwash.

These soils are used mainly for woodland, hay and pasture, recreational areas, and wildlife habitat.

13. Barneston-Klaus-Skykomish

Moderately deep and very deep, somewhat excessively drained and well drained, nearly level to very steep soils on terraces and terrace escarpments

This map unit is throughout the survey area. Slopes are 0 to 65 percent. The vegetation is conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is 50 to 100 inches, and the average annual air temperature is 45 to 50 degrees F. The average frost-free period is 120 to 190 days.

This unit makes up about 9 percent of the survey area. It is about 55 percent Barneston soils, 15 percent Klaus soils, 9 percent Skykomish soils, and 21 percent soils of minor extent.

Barneston soils are very deep and somewhat excessively drained. They formed in a mixture of volcanic ash and glacial outwash. Typically, the surface layer is gravelly coarse sandy loam. The subsoil is very gravelly sandy loam and extremely gravelly sand.

Klaus soils are moderately deep and well drained. They formed in a mixture of volcanic ash and alluvium over glacial outwash. Typically, the surface layer is sandy loam. The subsoil is gravelly sandy loam and very gravelly sand. Iron-cemented material is at a depth of 40 to 60 inches.

Skykomish soils are very deep and somewhat excessively drained. They formed in a mixture of volcanic ash and glacial outwash. Typically, the surface layer is gravelly sandy loam. The subsoil is very gravelly sandy loam and very gravelly loamy sand. The substratum is extremely gravelly coarse sand.

Of minor extent in this unit are Alderwood, Cinebar, Elwell, Norma, Ogarty, Olomount, Persis, Ragnar, and Rober soils and stony areas.

This unit is used for woodland, recreational areas, and wildlife habitat. The main limitation in areas of the Barneston soils used for hay and pasture is a low available water capacity. The main limitation in areas of the Klaus and Skykomish soils used for woodland is snowpack. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

14. Tokul-Blethen-Ogarty

Moderately deep and very deep, moderately well drained and well drained, nearly level to very steep soils in valleys and on mountain foot slopes, back slopes, side slopes, toe slopes, and drift plain escarpments

This map unit is in the western part of the survey area. Slopes are 0 to 90 percent. The vegetation is conifers and shrubs. Elevation is 500 to 1,800 feet. The

average annual precipitation is 50 to 75 inches, and the average annual air temperature is 46 to 50 degrees F. The average frost-free period is 150 to 180 days.

This unit makes up about 8 percent of the survey area. It is about 39 percent Tokul soils, 21 percent Blethen soils, 13 percent Ogarty soils, and 27 percent soils of minor extent.

Tokul soils are on mountain foot slopes and in valleys. They are moderately deep and moderately well drained. They formed in a mixture of volcanic ash and dense glacial till. Typically, the surface layer is gravelly loam. The subsoil also is gravelly loam. The substratum is gravelly fine sandy loam. Ortstein is at a depth of 20 to 40 inches.

Blethen soils are on mountain back slopes, side slopes, toe slopes, and drift plain escarpments. They are very deep and well drained. They formed in colluvium and slope alluvium derived from glacial drift. The colluvium and alluvium have an admixture of volcanic ash. Typically, the surface layer is gravelly loam. The subsoil is very gravelly loam, very gravelly sandy loam, and extremely gravelly sandy loam. The substratum is extremely gravelly loamy sand.

Ogarty soils are on back slopes in the foothills. They are moderately deep and well drained. They formed in a mixture of volcanic ash, colluvium, and residuum derived from andesite and breccia. Typically, the surface layer is gravelly loam. The subsoil is very gravelly sandy loam and extremely gravelly fine sandy loam. The substratum is extremely gravelly fine sandy loam. Fractured andesite is at a depth of 20 to 40 inches.

Of minor extent in this unit are Barneston, Beausite, and Pastik soils.

This unit is used for woodland, hay and pasture, recreational areas, and wildlife habitat. The main limitations in areas of the Tokul soils used for hay and pasture are a seasonal high water table and the hazard of erosion. The water table is the main limitation in the areas used for woodland. Few limitations affect the use of the Blethen and Ogarty soils for woodland. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

15. Tokul

Moderately deep, moderately well drained, nearly level to very steep soils in glacially modified areas on mountain foot slopes and in valleys

This map unit is in the northwestern part of the survey area. Slopes are 0 to 90 percent. The vegetation is conifers and shrubs. Elevation is 600 to 1,100 feet. The average annual precipitation is 50 to 70 inches,

and the average annual air temperature is about 50 degrees F. The average frost-free period is 160 to 180 days.

This unit makes up about 4 percent of the survey area. It is about 73 percent Tokul soils and 27 percent soils of minor extent.

Tokul soils formed in a mixture of volcanic ash and dense glacial till. Typically, the surface layer is gravelly loam. The subsoil also is gravelly loam. The substratum is gravelly fine sandy loam. Ortstein is at a depth of 20 to 40 inches.

Of minor extent in this unit are Barneston, Beausite, Norma, and Pastik soils and Rock outcrop.

This unit is used for woodland, recreational areas, and wildlife habitat. The main limitation in the areas used for woodland is seasonal wetness. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

16. Mashel-Scamman-National

Very deep, moderately well drained, somewhat poorly drained, and well drained, nearly level to very steep soils on terraces and foothill back slopes

This map unit is in the southwestern part of the survey area. Slopes are 0 to 65 percent. The vegetation is conifers and shrubs. Elevation is 700 to 1,800 feet. The average annual precipitation is 40 to 85 inches, and the average annual air temperature is 46 to 50 degrees F. The average frost-free period is 155 to 200 days.

This unit makes up about 3 percent of the survey area. It is about 41 percent Mashel soils, 23 percent Scamman soils, 18 percent National soils, and 18 percent soils of minor extent.

Mashel soils are on back slopes in the foothills. They are moderately well drained. They formed in glacial till. Typically, the surface layer is silt loam. The subsoil is silt loam, silty clay loam, and silty clay.

Scamman soils are on terraces and foothill back slopes. They are somewhat poorly drained. They formed in glacial and sedimentary material. Typically, the surface layer and subsurface layer are silt loam. The subsoil is silty clay.

National soils are on terraces. They are well drained. They formed in volcanic ash and pumice over alluvium. Typically, the surface layer is cindery sandy loam. The subsoil is very cindery loamy sand and loam. The substratum is silt loam.

Of minor extent in this unit are Cinebar, Greenwater, and Wilkeson soils and ponded areas.

This unit is used for woodland, hay and pasture, recreational areas, and wildlife habitat. The main

limitation in areas of the Mashel soils used for woodland is seasonal wetness. The Scamman soils are suitable for hay and pasture. If irrigated, the National soils also are suitable for hay and pasture. The slope and the hazard of erosion are management concerns in areas where the slope is more than 30 percent.

Soils on Flood Plains, Terraces, and Till Plains and in River Valleys

These soils make up about 1 percent of the survey area. They are nearly level. The native vegetation is mainly conifers and shrubs. Elevation is 30 to 800 feet. The average annual precipitation is 35 to 70 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is 140 to 200 days.

These soils are very deep and are well drained, moderately well drained, and very poorly drained. They formed in alluvium and organic deposits.

These soils are used mainly for crops, homesites, woodland, recreational areas, and wildlife habitat.

17. Edgewick-Seattle-Nooksack

Very deep, well drained, moderately well drained, and very poorly drained, nearly level soils on river terraces, on flood plains, in river valleys, and on glacial till plains

This map unit is in the northwestern part of the survey area. Slopes are 0 to 3 percent. The vegetation is conifers and shrubs. Elevation is 30 to 800 feet. The average annual precipitation is 35 to 70 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is 140 to 200 days.

This unit makes up about 1 percent of the survey area. It is about 32 percent Edgewick soils, 24 percent Seattle soils, 23 percent Nooksack soils, and 21 percent soils of minor extent.

Edgewick soils are on river terraces. They are well drained. They formed in alluvium. Typically, the surface layer is silt loam. The subsoil is silt loam, fine sandy loam, loamy sand, and very gravelly sand.

Seattle soils are in river valleys and on glacial till plains. They are very poorly drained. They formed in herbaceous and woody organic deposits. Typically, the surface layer is muck. The underlying layers are stratified, sapric and hemic material.

Nooksack soils are on flood plains and river terraces. They are moderately well drained. They formed in alluvium. Typically, the surface layer, subsoil, and substratum are silt loam.

Of minor extent in this unit are Belfast, Oridia, Pastik, and Puget soils.

This unit is used for crops, hay and pasture,

woodland, recreational areas, and wildlife habitat. The main limitation in the areas used for crops, hay, or pasture is a seasonal high water table. The main limitations in the areas used for woodland or homesite development are seasonal wetness and occasional flooding in areas of the Edgewick and Nooksack soils and a high water table and low bearing strength in the Seattle soils.

Broad Land Use Considerations

The general soil map is useful in determining the potential of the soils in an area for a general land use pattern. It is not suitable for selecting a specific site for a specific use or for designing management programs on individual farms. Specific information that is helpful in designing a detailed land use plan is given in the section "Detailed Soil Map Units" and in the tables.

About 90 percent of the survey area is covered by forests, which are in various stages of growth. The main land use is the production of timber. The productivity of western hemlock and Douglas fir is high in general soil map units 6, 7, 8, 11, 12, 14, and 15; moderate in map units 5, 9, 10, 13, and 16; and low in map units 1, 2, 3, and 4. Generally, productivity decreases as elevation

increases and as the proportion of rock fragments in the soil increases.

The slope and the hazard of erosion are management concerns in many of the wooded areas. Carefully constructing logging roads minimizes erosion and the sedimentation of streams. The use of tracked or wheeled equipment when the soil is moist compacts the soil and results in the formation of ruts. This equipment should be used only during the dry summer months.

Less than 2 percent of the survey area is used for hay and pasture. Most of the hayland and pasture is in general soil map units 14, 16, and 17. The soils in map unit 17 are subject to flooding during winter and early spring. The flooding causes minimal crop damage.

The recreational activities in the survey area include hiking, horseback riding, hunting, cross-country skiing, and downhill skiing. The potential for recreational development ranges from low to high, depending on the intensity of the expected use and the properties of the soil.

The potential for wildlife habitat is high throughout the survey area. The soils in map units 1 through 16 have high potential for woodland wildlife habitat. The soils in map unit 17 have high potential for openland wildlife habitat.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have

been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kaleetan sandy loam, windswept, 30 to 65 percent slopes, is a phase of the Kaleetan series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are called complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar

in all areas. Klaber-Cinebar silt loams, 0 to 8 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

1—Alderwood gravelly loam, 6 to 15 percent slopes. This moderately well drained soil is in glacially modified areas on foothills and in valleys. It is moderately deep to ortstein. It formed in dense glacial till. The native vegetation is mainly confers and shrubs. Elevation is 50 to 800 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 200 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 1.5 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown gravelly loam. The upper 14 inches of the subsoil is dark yellowish brown very gravelly loam. The lower 13 inches is dark yellowish brown very gravelly sandy loam. Grayish brown ortstein that crushes to very gravelly sandy loam is at a depth of about 33 inches. Below the ortstein is grayish brown, dense glacial till that crushes to very cobbly fine sandy loam. The depth to dense glacial till ranges from 20 to 40 inches. In some areas the surface layer is gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil or is 40 to 60 inches deep to cemented glacial till.

Included in this unit are small areas of Beausite, Everett, Lynnwood, Norma, and Oval soils and Alderwood soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Alderwood soil and very slow in the ortstein. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from December through May. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used as pasture or cropland, however, runoff is medium and the hazard of erosion is moderate.

This unit is used mainly as woodland. It also is used as pasture or cropland.

In the areas used as pasture or cropland, the main limitations are the slope and the muddiness caused by seasonal wetness. Proper stocking rates, pasture rotation, and restricted grazing during short wet periods help to keep the pasture in good condition and help to control runoff and erosion. Grazing when the soil is wet results in compaction of the surface layer and poor tilth.

Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western redcedar, western hemlock, and Pacific madrone. The common forest understory plants are salal, Oregon grape, western brackenfern, western swordfern, and evergreen huckleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 146. On the basis of a 50-year site curve, it is 111. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 153 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs periodically. Seedlings that are planted or naturally established in the less fertile subsoil grow poorly and lack vigor. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting

depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

2—Alderwood gravelly loam, 15 to 30 percent slopes. This moderately well drained soil is on glacially modified foothills. It is moderately deep to ortstein. It formed in dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 50 to 800 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 200 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 1.5 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown gravelly loam. The upper 14 inches of the subsoil is dark yellowish brown very gravelly loam. The lower 13 inches is dark yellowish brown very gravelly sandy loam. Grayish brown ortstein that crushes to very gravelly sandy loam is at a depth of about 33 inches. Below the ortstein is grayish brown, dense glacial till that crushes to very cobbly fine sandy loam. The depth to dense glacial till ranges from 20 to 40 inches. In some areas the surface layer is gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, has weathered bedrock at a depth of 40 to 60 inches, or is 40 to 60 inches deep to cemented glacial till.

Included in this unit are small areas of Everett, Kanaskat, Lynnwood, and Ovall soils and Alderwood soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Alderwood soil and very slow in the ortstein. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western redcedar, western hemlock, and Pacific madrone. The common forest understory plants are salal, Oregon grape, western brackenfern, western swordfern, and evergreen huckleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 146. On the basis of a 50-year site curve, it is 111. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 153 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of

wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected from unmanaged fires in undisturbed areas. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs periodically. Seedlings that are planted or naturally established in the less fertile subsoil grow poorly and lack vigor. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

3—Alkiridge sandy loam, 8 to 30 percent slopes. This moderately well drained soil is in cirque basins and on the adjacent valley floors. It is moderately deep to dense glacial till. It formed in volcanic ash, pumice, and cinders over dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 2,700 to 3,700 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, litter, and moss 1 inch thick. When mixed to a depth of 7 inches, the surface layer is dark brown sandy loam. The upper 11 inches of the subsoil is dark brown gravelly sandy loam. The lower 19 inches is dark yellowish brown and olive brown very gravelly loam. Brown, dense glacial till that crushes to very gravelly

sandy loam is at a depth of about 37 inches. The dense glacial till is similar to a cemented pan. The depth to dense glacial till ranges from 20 to 40 inches.

Included in this unit are small areas of Haywire and Nagrom soils and Alkiridge soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the upper part of the Alkiridge soil and very slow in the dense glacial till. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the dense glacial till from November through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Douglas fir, and western redcedar. The common forest understory plants are common beargrass, Oregon grape, salal, black mountain huckleberry, western swordfern, bunchberry dogwood, and Pacific trillium.

On the basis of a 100-year site curve, the mean site index for western hemlock is 132. On the basis of a 50-year site curve, it is 95. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 202 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. A moderate reduction in productivity can be expected from unmanaged fires in undisturbed areas. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the

growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the dense glacial till, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

4—Altapeak gravelly sandy loam, 8 to 30 percent slopes. This deep, well drained soil is on mountain slopes. It formed in volcanic ash and pumice mixed with residuum and colluvium over granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,600 to 5,600 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 10 inches of the subsoil is dark reddish brown very gravelly sandy loam. The lower 8 inches is strong brown very cobbly loamy sand. The substratum extends to a depth of 50 inches. It is pale yellow and grayish brown extremely cobbly loamy sand and extremely gravelly coarse sand. Highly weathered granodiorite is at a depth of about 50 inches. The depth to granitic or metamorphic rocks ranges from 40 to 60 inches. In some areas the surface layer is loamy sand, sandy loam, or gravelly loam. In other areas the soil is underlain by conglomerate.

Included in this unit are small areas of Serene soils, soils that are 10 to 20 inches deep over bedrock, Rock outcrop, and Altapeak soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Altapeak soil. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Alaska cedar, and mountain hemlock. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, huckleberry, prince's pine, deer fern, lupine, salal, and cascade azalea.

On the basis of a 100-year site curve, the mean site

index for western hemlock is estimated to be 88. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 102 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. A moderate reduction in productivity can be expected from unmanaged fires in undisturbed areas. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the hazard of displacement.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIe.

5—Altapeak gravelly sandy loam, 30 to 65 percent slopes. This deep, well drained soil is on mountain slopes. It formed in volcanic ash and pumice mixed with residuum and colluvium over granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,600 to 5,600 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of

needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 10 inches of the subsoil is dark reddish brown very gravelly sandy loam. The lower 8 inches is strong brown very cobbly loamy sand. The substratum extends to a depth of 50 inches. It is pale yellow and grayish brown extremely cobbly loamy sand and extremely gravelly coarse sand. Highly weathered granodiorite is at a depth of about 50 inches. The depth to granitic or metamorphic rocks ranges from 40 to 60 inches. In some areas the surface layer is loamy sand, sandy loam, or gravelly loam. In other areas the soil is underlain by conglomerate.

Included in this unit are small areas of Haywire and Serene soils, soils that are 10 to 20 inches deep over bedrock, Rock outcrop, and Altapeak soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Altapeak soil. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Alaska cedar, and mountain hemlock. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, blue huckleberry, princes pine, deer fern, lupine, salal, and cascade azalea.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 88. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 102 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for

road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and the hazard of erosion.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIIe.

6—Altapeak gravelly sandy loam, 65 to 90 percent slopes. This deep, well drained soil is on mountain slopes. It formed in volcanic ash and pumice mixed with residuum and colluvium over granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,600 to 5,600 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 10 inches of the subsoil is dark reddish brown very gravelly sandy loam. The lower 8 inches is strong brown very cobbly loamy sand. The substratum extends to a depth of 50 inches. It is pale yellow and grayish brown extremely cobbly loamy sand and extremely gravelly coarse sand. Highly weathered granodiorite is at a depth of about 50 inches. The depth to granitic or metamorphic rocks ranges from 40 to 60 inches. In some areas the surface layer is loamy sand, sandy loam, or gravelly loam. In other areas the soil is underlain by conglomerate.

Included in this unit are small areas of Haywire and Serene soils, soils that are 10 to 20 inches deep over bedrock, Rock outcrop, and Altapeak soils that have

slopes of less than 65 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Altapeak soil. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Alaska cedar, and mountain hemlock. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, blue huckleberry, princes pine, deer fern, lupine, salal, and cascade azalea.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 88. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 102 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the

surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock or Pacific silver fir occurs periodically.

This unit is in capability subclass VIIe.

7—Altapeak-Rock outcrop complex, 45 to 90 percent slopes. This map unit is on mountain slopes. The native vegetation is mainly conifers and shrubs. Elevation is 3,600 to 5,600 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

This unit is 45 percent Altapeak gravelly sandy loam and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Reggad, Serene, and Treen soils, talus, soils that are 10 to 20 inches deep over bedrock, and Altapeak soils that have slopes of less than 45 percent. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Altapeak soil is deep and well drained. It formed in volcanic ash and pumice mixed with residuum and colluvium over granitic and metamorphic rocks. Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 10 inches of the subsoil is dark reddish brown very gravelly sandy loam. The lower 8 inches is strong brown very cobbly loamy sand. The substratum extends to a depth of 50 inches. It is pale yellow and grayish brown extremely cobbly loamy sand and extremely gravelly coarse sand. Highly weathered granodiorite is at a depth of about 50 inches. The depth to granitic or metamorphic rocks ranges from 40 to 60 inches. In some areas the surface layer is loamy sand, sandy loam, or gravelly loam. In other areas the soil is underlain by conglomerate.

Permeability is moderately rapid in the Altapeak soil. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is granitic or metamorphic rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Western hemlock and

Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Alaska cedar, and mountain hemlock. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, blue huckleberry, prince's pine, deer fern, lupine, salal, and cascade azalea.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 88. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 102 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 30 percent of this unit.

The main limitations affecting timber harvesting are snowpack, the Rock outcrop, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation.

The Altapeak soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

8—Andic Cryumbrepts, 30 to 90 percent slopes.

These moderately deep to very deep, well drained soils are on cirque sidewalls. They formed in volcanic ash, glacial till, and colluvium derived from basalt and andesite. The native vegetation is mainly conifers and shrubs. Elevation is 4,000 to 6,500 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

No single profile is representative of these soils. One of the more commonly observed ones, however, is covered with a mat of needles and twigs about 0.5 inch thick. Typically, the surface layer is very dark grayish brown very gravelly sandy loam 5 inches thick. The upper 11 inches of the subsoil is dark yellowish brown very gravelly sandy loam. The lower 28 inches is dark brown extremely gravelly sandy loam. Andesite is at a depth of about 44 inches. The depth to bedrock is 20 to more than 60 inches. The content of rock fragments ranges from 25 to 75 percent. The dark surface layer is 7 to 15 inches thick.

Included in this unit are small areas of Haywire soils and Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Andic Cryumbrepts. Available water capacity is low. The effective rooting depth is 20 to more than 60 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are subalpine fir and mountain hemlock. The common forest understory plants are pinemat manzanita, black mountain huckleberry, lupine, dwarf huckleberry, and bitter cherry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 74. On the

basis of a 50-year site curve, it is estimated to be 55. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 79 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. During an average year, snowpack limits the use of equipment and restricts access from November through April. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are slippery and soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. The areas most susceptible to landslides are those underlain by dense glacial till. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Equipment and logs on the surface result in a high degree of soil compaction when the soils are moist and a high degree of puddling when the soils are wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock, mountain hemlock, or Pacific silver fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs periodically. Because the rooting depth is restricted by the glacial till and bedrock in some areas,

trees are occasionally subject to windthrow when the soils are wet and winds are strong.

This unit is in capability subclass VIIe.

9—Arents, 0 to 8 percent slopes. These moderately deep to very deep, moderately well drained to somewhat excessively drained soils formed in a mixture of volcanic ash and a variety of glacial deposits. They are on terraces and drift plains. Elevation is 1,000 to 3,000 feet. The average annual precipitation is about 45 to 90 inches, and the average annual air temperature is about 42 to 48 degrees F. The average frost-free period is about 125 days.

No single profile is representative of these soils. In one of the more commonly observed ones, however, the surface layer is dark yellowish brown gravelly sandy loam about 35 inches thick. The underlying material to a depth of 60 inches is dark yellowish brown extremely gravelly sand. The depth to dense glacial till ranges from 30 to more than 60 inches. In many areas the surface layer is dark brown very gravelly loam.

Included in this unit are small areas of Alderwood, Barneston, Chinkmin, Norma, Persis, Ragnar, Skykomish, and Tokul soils. Included areas make up about 10 percent of the total acreage.

Permeability is moderate or moderately rapid in the Arents. Available water capacity is low. The effective rooting depth is 60 inches. Runoff is slow, and the hazard of water erosion is slight.

These soils vary too much to be rated for potential uses. Onsite evaluation is needed. These are disturbed soils. They are used as sites for mill yards, sorting yards, parking lots, mills, dams, and old towns. Some areas are reverting to trees.

This unit is in capability subclass IVs.

10—Barneston gravelly coarse sandy loam, 0 to 6 percent slopes. This very deep, somewhat excessively drained soil is on outwash terraces. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,400 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 180 days.

Typically, the surface is covered with a mat of needles, decomposed roots, leaves, and twigs 2 inches thick. The surface layer is dark grayish brown gravelly coarse sandy loam 9 inches thick. The subsoil is dark yellowish brown very gravelly sandy loam 5 inches thick. The upper 7 inches of the substratum is dark brown extremely gravelly sand. The lower part to a depth of 60 inches is dark yellowish brown extremely gravelly sand. The depth to extremely gravelly sand

ranges from 14 to 20 inches. In some areas the surface layer is gravelly loam, gravelly sandy loam, very gravelly sandy loam, or very gravelly coarse sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, has a substratum of extremely gravelly sand at a depth of 24 to 36 inches, has a better developed subsoil, or has a substratum of very gravelly sandy loam.

Included in this unit are small areas of Alderwood, Norma, and Ragnar soils, Barneston soils that have a stony surface, and Barneston soils that have slopes of more than 6 percent. Included areas make up about 10 to 35 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Barneston soil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used for hay and pasture and as a source of aggregate. In the areas used for hay and pasture, the main limitation is the low available water capacity.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock and western redcedar. The common forest understory plants are Oregon grape, salal, western swordfern, western brackenfern, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135. On the basis of a 50-year site curve, it is 105. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 138 cubic feet per acre per year, occurring at age 70.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are

available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of planted Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

11—Barneston gravelly coarse sandy loam, 6 to 30 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,400 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, decomposed roots, leaves, and twigs 2 inches thick. The surface layer is dark grayish brown gravelly coarse sandy loam 9 inches thick. The subsoil is dark yellowish brown very gravelly sandy loam 5 inches thick. The upper 7 inches of the substratum is dark brown extremely gravelly sand. The lower part to a depth of 60 inches is dark yellowish brown extremely gravelly sand. The depth to extremely gravelly sand ranges from 14 to 20 inches. In some areas the surface layer is gravelly loam, gravelly sandy loam, very gravelly sandy loam, or very gravelly coarse sandy loam. In other areas the soil has less than 35 percent rock fragments in the subsoil, has a substratum of extremely gravelly sand at a depth of 24 to 36 inches, has a better developed subsoil, or has a substratum of very gravelly sandy loam.

Included in this unit are small areas of Nargar, Norma, Ogarty, and Tokul soils and Barneston soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Barneston soil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used as a source of aggregate.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock and western redcedar. The common forest understory plants are Oregon grape, salal, western swordfern, western brackenfern, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135. On the basis of a 50-year

site curve, it is 105. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 138 cubic feet per acre per year, occurring at age 70.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

12—Barneston gravelly coarse sandy loam, 30 to 65 percent slopes. This very deep, somewhat excessively drained soil is on outwash terraces and terrace escarpments. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,400 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, decomposed roots, leaves, and twigs 2 inches thick. The surface layer is dark grayish brown gravelly coarse sandy loam 9 inches thick. The subsoil is dark yellowish brown very gravelly sandy loam 5 inches thick. The upper 7 inches of the substratum is dark brown extremely gravelly sand. The lower part to a depth of 60 inches is dark yellowish brown extremely gravelly sand. The depth to extremely gravelly sand

ranges from 14 to 20 inches. In some areas the surface layer is gravelly loam, gravelly sandy loam, very gravelly sandy loam, or very gravelly coarse sandy loam. In other areas the soil has less than 35 percent rock fragments in the subsoil, has a substratum of extremely gravelly sand at a depth of 24 to 36 inches, has a better developed subsoil, or has a substratum of very gravelly sandy loam.

Included in this unit are small areas of Nargar, Ogarty, and Tokul soils and Barneston soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Barneston soil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly as woodland. It also is used as a source of aggregate.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock and western redcedar. The common forest understory plants are Oregongrape, salal, western swordfern, western brackenfern, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 152 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. A

low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

13—Barneston gravelly sandy loam, 0 to 8 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,400 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 9 inches, the surface layer is dark grayish brown gravelly sandy loam. The subsoil is dark yellowish brown very gravelly sandy loam 8 inches thick. The substratum to a depth of 60 inches is extremely gravelly sand. It is variegated but is dominantly grayish brown. The depth to extremely gravelly sand ranges from 14 to 20 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or cobbly loam. In other areas the soil has less than 35 percent rock fragments in the subsoil, has a substratum of extremely gravelly sand at a depth of 24 to 36 inches, or has a substratum of very gravelly sandy loam.

Included in this unit are small areas of Nargar, Ogarty, and Tokul soils, Norma soils in depressions, and Barneston soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Barneston soil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used as a source of aggregate.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock and western redcedar. The common forest understory plants are Oregongrape, salal, western swordfern, western brackenfern, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 150. On the basis of a 50-year

site curve, it is 118. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 158 cubic feet per acre per year, occurring at age 60.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

14—Barneston gravelly sandy loam, 8 to 30 percent slopes. This very deep, somewhat excessively drained soil is on outwash terraces and terrace escarpments. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 700 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 49 degrees F. The average frost-free period is about 180 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 9 inches, the surface layer is dark grayish brown gravelly sandy loam. The subsoil is dark yellowish brown very gravelly sandy loam 8 inches thick. The substratum to a depth of 60 inches is extremely gravelly sand. It is variegated but is dominantly grayish brown. The depth to extremely gravelly sand ranges from 14 to 20 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam. In other areas

the soil has a substratum of very gravelly sand at a depth of 24 to 36 inches, has 15 to 35 percent rock fragments in the subsoil, or has a substratum of very gravelly sandy loam.

Included in this unit are small areas of Alderwood and Ragnar soils, Barneston soils that have a stony surface, and Barneston soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Barneston soil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used as a source of aggregate.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock and western redcedar. The common forest understory plants are Oregongrape, salal, western swordfern, western brackenfern, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 150. On the basis of a 50-year site curve, it is 118. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 158 cubic feet per acre per year, occurring at age 60.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of planted Douglas fir

seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

15—Barneston gravelly sandy loam, 30 to 65 percent slopes. This very deep, somewhat excessively drained soil is on outwash terrace escarpments. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 700 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 49 degrees F. The average frost-free period is about 180 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 9 inches, the surface layer is dark grayish brown gravelly sandy loam. The subsoil is dark yellowish brown very gravelly sandy loam 8 inches thick. The substratum to a depth of 60 inches is extremely gravelly sand. It is variegated but is dominantly grayish brown. The depth to extremely gravelly sand ranges from 14 to 20 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or gravelly loam. In other areas the soil has a substratum of very gravelly sand at a depth of 24 to 36 inches, has 15 to 35 percent rock fragments in the subsoil, or has a substratum of very gravelly sandy loam.

Included in this unit are small areas of Alderwood and Ragnar soils, Barneston soils that have a stony surface, and Barneston soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Barneston soil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly as woodland. It also is used as a source of aggregate.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock and western redcedar. The common forest understory plants are Oregongrape, salal, western swordfern, western brackenfern, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 150. On the basis of a 50-year site curve, it is 118. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 158 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is the slope. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable

yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment and mortality are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of planted Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

16—Barneston gravelly sandy loam, windswept, 6 to 30 percent slopes. This very deep, somewhat excessively drained soil is on terraces. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,400 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 9 inches, the surface layer is dark grayish brown gravelly sandy loam. The subsoil is yellowish brown very gravelly sandy loam 8 inches thick. The substratum to a depth of 60 inches is extremely gravelly sand. It is variegated but is dominantly grayish brown. The depth to extremely gravelly sand ranges from 14 to 20 inches. In some areas the surface layer is very gravelly loam, very gravelly sandy loam, or cobbly loam. In other areas the subsoil has less than 35 percent rock

fragments, the substratum of extremely gravelly sand is at a depth of 24 to 36 inches, or the substratum is very gravelly sandy loam.

Included in this unit are small areas of Nargar, Ogarty, and Tokul soils, Norma soils in depressions, and Barneston soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Barneston soil and very rapid in the substratum. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used as a source of aggregate.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock and western redcedar. The common forest understory plants are Oregongrape, salal, western swordfern, western brackenfern, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 133. On the basis of a 50-year site curve, it is estimated to be 100. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 134 cubic feet per acre per year, occurring at age 70. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the

uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

17—Beausite gravelly loam, 6 to 30 percent slopes. This well drained soil is on foothills. It is moderately deep to sandstone. It formed in glacial till and in colluvium derived dominantly from sandstone. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,500 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 200 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The upper 5 inches of the surface layer is black gravelly loam. The lower 6 inches is dark brown very gravelly loam. The upper 18 inches of the subsoil is dark brown and dark yellowish brown extremely gravelly sandy loam. The lower part is light olive brown extremely gravelly sandy loam 7 inches thick. Sandstone is at a depth of about 36 inches. The depth to sandstone ranges from 24 to 40 inches. In some areas the surface layer is gravelly sandy loam. In other areas the soil is 40 to 60 inches deep to sandstone or has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Tokul soils and Beausite soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Beausite soil. Available water capacity is low. The effective rooting depth is 24 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are salal, Oregongrape, oceanspray, red huckleberry, blueleaved huckleberry, and swordfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 155. On the basis of a 50-year site curve, it is 118. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 164 cubic feet per acre per year, occurring at age 60.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. The rock available for road construction is poor-quality

sandstone. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

18—Beausite gravelly loam, 30 to 65 percent slopes. This well drained soil is on foothills. It is moderately deep to sandstone. It formed in glacial till and in colluvium derived dominantly from sandstone. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,500 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 200 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The upper 5 inches of the surface layer is black gravelly loam. The lower 6 inches is dark yellowish brown very gravelly sandy loam. The upper 18 inches of the subsoil is dark brown and dark yellowish brown extremely gravelly sandy loam. The lower part is light olive brown extremely gravelly sandy loam 7 inches thick. Sandstone is at a depth of about 36 inches. The depth to sandstone ranges from 24 to 40 inches. In some areas the surface layer is gravelly sandy loam. In other areas the soil is 40 to 60 inches deep to sandstone or has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Tokul soils and Beausite soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Beausite soil. Available water capacity is low. The effective rooting depth is 24 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are salal, Oregongrape, oceanspray, red huckleberry, blueleaved huckleberry, and swordfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 155. On the basis of a 50-year site curve, it is 118. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 164 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

19—Beausite gravelly loam, 65 to 90 percent slopes. This well drained soil is on foothills. It is moderately deep to sandstone. It formed in glacial till and in colluvium derived dominantly from sandstone. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,500 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 200 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The upper 5 inches of the surface layer is black gravelly loam. The lower 6 inches is dark brown very gravelly loam. The upper 18 inches of the subsoil is dark brown and dark yellowish brown extremely gravelly sandy loam. The lower part is light olive brown extremely gravelly sandy loam 7 inches thick. Sandstone is at a depth of about 36 inches. The depth to sandstone ranges from 24 to 40 inches. In some areas the surface layer is gravelly sandy loam. In other areas the soil is 40 to 60 inches deep to sandstone or has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Tokul soils and Beausite soils that have slopes of less than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Beausite soil. Available water capacity is low. The effective rooting depth is 24 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are salal, Oregongrape, oceanspray, red huckleberry, blueleaved huckleberry, and swordfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 150. On the basis of a 50-year site curve, it is 111. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 158 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

20—Belfast silt loam, 0 to 2 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 50 to 120 feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface layer is brown silt loam 7 inches thick. The upper 9 inches of the underlying material is brown silt loam. The next 22 inches is brown and pale brown fine sandy loam. The lower part to a depth of 60 inches is grayish brown, stratified fine sandy loam and loamy fine sand. In some areas the surface layer is loam or very fine sandy loam. In other areas the soil has less than 50 percent base saturation in the surface layer or has a sandy substratum.

Included in this unit are small areas of Nooksack and Oridia soils and Belfast soils that have slopes of more than 2 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Belfast soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 3.5 to 6.0 feet from November through March. Runoff is very slow, and there is no hazard of erosion.

This soil is subject to occasional, brief periods of flooding from November through March. Channeling and deposition are common along streambanks.

This unit is used mainly as hayland, pasture, or cropland. It also is used as woodland and as a site for homes.

In the areas used for hay and pasture, proper stocking rates, pasture rotation, and restricted grazing during short wet periods help to keep the pasture in good condition and help to control runoff and erosion. In summer, irrigation is required for maximum production.

The main hazard in the areas used as cropland is the flooding. This unit is suited to all of the crops commonly grown in the survey area. The principal crops are oats and corn silage. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are black cottonwood, red alder, bigleaf maple, and western redcedar. The common forest understory plants are brackenfern, western swordfern, salal, Oregongrape, vine maple, trailing blackberry, and salmonberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 160. On the basis of a 50-year site curve, it is estimated to be 120. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 170 cubic feet per acre per year, occurring at age 65.

The main hazard affecting timber harvesting is the flooding, which limits the use of equipment to dry periods. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. The occasional flooding hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of

seedlings. Competing vegetation can be controlled by mechanical or chemical means.

In the areas used for homesite development, the main hazard is the flooding. The main limitations on sites for septic tank absorption fields are a poor filtering capacity in the substratum and the flooding. Septic tank absorption fields may not function properly during rainy periods because of wetness. Installing the absorption field in fill approved by the health district helps to overcome these limitations.

This unit is in capability subclass IIIw.

21—Bellicum very cindery loamy sand, 8 to 30 percent slopes.

This deep, well drained soil is on mountain back slopes. It formed in a mantle of pumice and volcanic ash over residuum and colluvium derived dominantly from porphyritic andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 6 inches, the surface layer is strong brown very cindery loamy sand. The upper 15 inches of the subsoil is yellowish red and grayish brown extremely cindery loamy sand. The lower 18 inches is dark yellowish brown very cobbly sandy loam. The substratum is dark yellowish brown extremely cobbly sandy loam 13 inches thick. Fractured andesite is at a depth of about 52 inches. The depth to andesite ranges from 40 to 60 inches. In some areas the surface layer is cindery loamy sand or loamy sand. In other areas, the soil is more than 60 inches deep over bedrock or the bedrock is sandstone.

Included in this unit are small areas of Bromo soils and Bellicum soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Bellicum soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, Pacific silver fir, and western redcedar. The common forest understory plants are Oregongrape, red huckleberry, salal, western swordfern, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index is 141 for Douglas fir and 160 for western hemlock. On the basis of a 50-year site curve, it is 112 for Douglas fir and western hemlock. The highest

average growth rate in unmanaged, even-aged stands of Douglas fir is 146 cubic feet per acre per year, occurring at age 65. For western hemlock it is 254 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rock for road construction is readily available. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or Pacific silver fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Seedlings that are planted or naturally established in the less fertile subsoil grow poorly and lack vigor. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants hinders the growth of the seedlings. Competing vegetation can be controlled by mechanical or chemical means. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass IVe.

22—Bellicum very cindery loamy sand, 30 to 65 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in a mantle of pumice and volcanic ash over residuum and colluvium derived dominantly from porphyritic andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 6 inches, the surface layer is strong brown very cindery loamy sand. The upper 15 inches of the subsoil is yellowish red and grayish brown extremely cindery loamy sand. The lower 18 inches is dark yellowish brown very cobbly sandy loam. The substratum is dark yellowish brown extremely cobbly sandy loam 13 inches thick. Fractured andesite is at a depth of about 52 inches. The depth to andesite ranges from 40 to 60 inches. In some areas the surface layer is cindery loamy sand or loamy sand. In other areas, the soil is more than 60 inches deep over bedrock or the bedrock is sandstone.

Included in this unit are small areas of Bromo soils and Bellicum soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Bellicum soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, Pacific silver fir, and western redcedar. The common forest understory plants are Oregon grape, red huckleberry, salal, western swordfern, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index is 141 for Douglas fir and 160 for western hemlock. On the basis of a 50-year site curve, it is 112 for Douglas fir and western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 146 cubic feet per acre per year, occurring at age 65. For western hemlock it is 254 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Logging roads require suitable surfacing for year-round use. Rock for road construction is readily available. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged

fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or Pacific silver fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Seedlings that are planted or naturally established in the less fertile subsoil grow poorly and lack vigor. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass VIIe.

23—Blethen gravelly loam, 5 to 30 percent slopes.

This very deep, well drained soil is on mountain back slopes and toe slopes. It formed in colluvium and slope alluvium derived from glacial drift. The colluvium and alluvium have an admixture of volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 5 inches thick. The surface layer is very dark grayish brown gravelly loam 5 inches thick. The upper 19 inches of the subsoil is dark brown very gravelly loam and very gravelly sandy loam. The lower 18 inches is dark yellowish brown extremely gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown extremely gravelly loamy sand. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Barneston, Ogarty, and Tokul soils and Blethen soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Blethen soil.

Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, red alder, bigleaf maple, and western redcedar. The common forest understory plants are salal, Oregon grape, vine maple, red huckleberry, western swordfern, longtube twinflower, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 149. On the basis of a 50-year site curve, it is 115. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 157 cubic feet per acre per year, occurring at age 60.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

24—Blethen gravelly loam, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in colluvium and slope alluvium derived from glacial drift. The colluvium and alluvium

have an admixture of volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 5 inches thick. The surface layer is very dark grayish brown gravelly loam 5 inches thick. The upper 9 inches of the subsoil is dark brown very gravelly loam and very gravelly sandy loam. The lower 18 inches is dark yellowish brown extremely gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown extremely gravelly loamy sand. In some areas the surface layer is gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Barneston, Ogarty, and Tokul soils, Rock outcrop, and Blethen soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Blethen soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, red alder, bigleaf maple, and western redcedar. The common forest understory plants are salal, Oregongrape, vine maple, red huckleberry, western swordfern, longtube twinflower, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 149. On the basis of a 50-year site curve, it is 115. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 157 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is

established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment and mortality are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

25—Borohemists, 0 to 2 percent slopes. These very deep, very poorly drained soils are in depressions on river terraces and mountains. They formed in partially decomposed herbaceous plant material over decomposed woody material and in varying amounts of alluvium or mudflow deposits. The native vegetation is mainly shrubs and sedges. Elevation is 1,400 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 160 days.

No single profile is representative of these soils. In one of the more commonly observed ones, however, the surface layer is very dark brown mucky peat about 4 inches thick. The upper 26 inches of the underlying material is very dark grayish brown hemic material. The next 4 inches is very dark grayish brown sandy loam. The lower part to a depth of 60 inches is dark reddish brown hemic material. The depth to hemic material ranges from 20 to more than 60 inches. After rubbing, the overall content of fiber ranges from 20 to 30 percent, although individual layers can have as much as 50 percent. Reaction is extremely acid or very strongly acid.

Included in this unit are small areas of ponded mineral soils and Ohop soils. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Borohemists. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at or above the surface from October through June. Runoff is ponded, and there is no hazard of erosion.

This unit is used for wildlife habitat. The native

vegetation consists of hardhack, cattail, western redcedar, rushes, and sedges.

This unit is in capability subclass Vw.

26—Bromo very cindery sandy loam, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 165 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The upper 4 inches of the surface layer is very dark brown very cindery sandy loam. The lower 9 inches is dark brown and light brownish gray very cindery loamy sand. The subsoil is yellowish red, strong brown, light brownish gray, and reddish yellow very cindery sand about 19 inches thick. The substratum to a depth of 60 inches is dark brown sandy loam. In some areas the surface layer is cindery sandy loam or very cindery loamy sand. In other areas the soil has 15 to 50 percent rock fragments in the lower part of the subsoil and is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Cotteral soils and Bromo soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very rapid in the upper part of the Bromo soil and moderate in the substratum. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, Pacific silver fir, and bigleaf maple. The common forest understory plants are Oregongrape, western brackenfern, western swordfern, vine maple, and salal.

On the basis of a 100-year site curve, the mean site index is 151 for Douglas fir and western hemlock. On the basis of a 50-year site curve, it is 118 for Douglas fir and 106 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 159 cubic feet per acre per year, occurring at age 60. For western hemlock it is 240 cubic feet per acre per year, occurring at age 50. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are

the slope, occasional snowpack, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. During an average year, snowpack limits the use of equipment and restricts access from January through March. Rock for road construction is not readily available. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. Seedlings that are planted or naturally established in the less fertile upper part of the subsoil grow poorly and lack vigor. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass VIIe.

27—Cattcreek very cindery loamy sand, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes and in cirque basins. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation generally is 2,800 to 4,000 feet. Some areas, however, extend to 5,300 feet. The average annual precipitation is about 105 inches, and the average annual air temperature is about 39 degrees F. The average frost-free period is about 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark brown very cindery loamy sand 7 inches thick. The upper 4 inches of the subsoil is strong brown very cindery loamy sand. The next 10 inches is strong brown very cindery sand. The lower part to a depth of 60 inches is dark yellowish brown and olive brown very gravelly sandy loam. In some areas the surface layer is extremely cindery or cindery loamy sand. In other areas the soil is 40 to 60 inches deep to andesite or sandstone, has 15 to 35 percent rock fragments in the substratum, or is 30 to 60 inches deep to dense glacial till.

Included in this unit are small areas of Cotteral soils and Cattcreek soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very rapid in the upper part of the Cattcreek soil and moderate in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, western white pine, and Alaska cedar. The common forest understory plants are common beargrass, longtube twinflower, western brackenfern, evergreen blackberry, black mountain huckleberry, princes pine, and tall blue huckleberry.

On the basis of a 100-year site curve, the mean site index is 124 for western hemlock and is estimated to be 117 for Douglas fir. On the basis of a 50-year site curve, it is 86 for western hemlock and is estimated to be 90 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 188 cubic feet per acre per year, occurring at age 50. For Douglas fir it is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road

construction is readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting Douglas fir, noble fir, or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and western hemlock occurs periodically. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass VIIe.

28—Cattcreek very cindery loamy sand, 65 to 90 percent slopes. This very deep, well drained soil is on mountain back slopes and in cirque basins. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation generally is 2,800 to 4,000 feet. Some areas, however, extend to 5,300 feet. The average annual precipitation is about 105 inches, and the average annual air temperature is about 39 degrees F. The average frost-free period is about 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark brown very cindery loamy sand 7 inches thick. The upper 4 inches of the subsoil is strong brown very cindery loamy sand. The next 10 inches is strong brown very cindery sand. The lower part to a depth of 60 inches is dark yellowish brown and olive brown very gravelly sandy loam. In some areas the surface layer is extremely cindery or cindery loamy sand. In other areas the soil is 40 to 60 inches deep to andesite or

sandstone, has 15 to 35 percent rock fragments in the substratum, or is 30 to 60 inches deep to dense glacial till.

Included in this unit are small areas of Cotteral soils and Cattcreek soils that have slopes of less than 65 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very rapid in the upper part of the Cattcreek soil and moderate in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, western white pine, and Alaska cedar. The common forest understory plants are common beargrass, longtube twinflower, western brackenfern, evergreen blackberry, black mountain huckleberry, princes pine, and tall blue huckleberry.

On the basis of a 100-year site curve, the mean site index is 124 for western hemlock and is estimated to be 117 for Douglas fir. On the basis of a 50-year site curve, it is 86 for western hemlock and is estimated to be 90 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 188 cubic feet per acre per year, occurring at age 50. For Douglas fir it is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is

dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting Douglas fir, noble fir, or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and western hemlock occurs periodically. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass VIIe.

29—Cattcreek very cindery loamy sand, sandstone substratum, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes and in cirque basins. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from sandstone. The native vegetation is mainly conifers and shrubs. Elevation generally is 2,800 to 4,000 feet. Some areas, however, extend to 5,300 feet. The average annual precipitation is about 105 inches, and the average annual air temperature is about 39 degrees F. The average frost-free period is about 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown very cindery loamy sand 7 inches thick. The upper part of the subsoil is reddish brown and strong brown extremely cindery coarse sand 24 inches thick. The lower part to a depth of 60 inches is dark brown and dark yellowish brown extremely gravelly sandy loam. In some areas the surface layer is extremely cindery loamy sand. In other areas the soil has 15 to 35 percent rock fragments in the substratum, is 30 to 60 inches deep to dense glacial till, or is underlain by andesite or sandstone at a depth of 40 to 60 inches.

Included in this unit are small areas of Cotteral soils and Cattcreek soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very rapid in the upper part of the

Cattcreek soil and moderate in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, western white pine, and Alaska cedar. The common forest understory plants are common beargrass, longtube twinflower, western brackenfern, evergreen blackberry, black mountain huckleberry, prince's pine, and tall blue huckleberry.

On the basis of a 100-year site curve, the mean site index is 124 for western hemlock and is estimated to be 117 for Douglas fir. On the basis of a 50-year site curve, it is 86 for western hemlock and is estimated to be 90 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 188 cubic feet per acre per year, occurring at age 50. For Douglas fir it is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low

content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting Douglas fir, noble fir, or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and western hemlock occurs periodically. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass VIIe.

30—Cattcreek very cindery loamy sand, sandstone substratum, 65 to 90 percent slopes. This very deep, well drained soil is on mountain back slopes and in cirque basins. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from sandstone. The native vegetation is mainly conifers and shrubs. Elevation generally is 2,800 to 4,000 feet. Some areas, however, extend to 5,300 feet. The average annual precipitation is about 105 inches, and the average annual air temperature is about 39 degrees F. The average frost-free period is about 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown very cindery loamy sand 7 inches thick. The upper part of the subsoil is reddish brown and strong brown extremely cindery coarse sand 24 inches thick. The lower part to a depth of 60 inches is dark brown and dark yellowish brown extremely gravelly sandy loam. In some areas the surface layer is extremely cindery loamy sand. In other areas the soil has 15 to 35 percent rock fragments in the substratum, is 30 to 60 inches deep to dense glacial till, or is underlain by andesite or sandstone at a depth of 40 to 60 inches.

Included in this unit are small areas of Cottrel and Vailton soils, organic soils in depressions, and Cattcreek soils that have slopes of less than 65 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very rapid in the upper part of the Cattcreek soil and moderate in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, western white pine, and Alaska cedar. The common forest understory plants are

common beargrass, longtube twinflower, western brackenfern, evergreen blackberry, black mountain huckleberry, prince's pine, and tall blue huckleberry.

On the basis of a 100-year site curve, the mean site index is 124 for western hemlock and is estimated to be 117 for Douglas fir. On the basis of a 50-year site curve, it is 86 for western hemlock and is estimated to be 90 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 188 cubic feet per acre per year, occurring at age 50. For Douglas fir it is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying sandstone. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting Douglas fir, noble fir, or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are

available, natural reforestation of cutover areas by Pacific silver fir and western hemlock occurs periodically. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass VIIe.

31—Cattcreek very cindery loamy sand, till substratum, 8 to 30 percent slopes. This deep, well drained soil is on till plains and in cirque basins. It formed in dacitic pumice and volcanic ash, colluvium and slope alluvium derived from andesite and sandstone, and glacial till. The native vegetation is mainly conifers and shrubs. Elevation generally is 2,800 to 4,000 feet. Some areas, however, extend to 5,300 feet. The average annual precipitation is about 105 inches, and the average annual air temperature is about 39 degrees F. The average frost-free period is about 110 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark brown and dark reddish brown very cindery loamy sand 8 inches thick. The upper part of the subsoil is strong brown and brownish yellow very cindery sand 9 inches thick. The next 5 inches is dark brown and strong brown very gravelly silt loam. The next 20 inches is dark brown and dark yellowish brown very gravelly loam. The lower part to a depth of 50 inches is dark grayish brown extremely gravelly sandy loam. Very dark grayish brown, dense glacial till that crushes to extremely gravelly sandy loam is below a depth of about 50 inches. The dense glacial till is similar to a cemented pan. The depth to dense glacial till ranges from 40 to 60 inches. In some areas the surface layer is cindery loamy sand. In other areas the soil is more than 60 inches deep to dense glacial till or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Cotteral soils and Cattcreek soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is rapid in the upper part of the Cattcreek soil, moderate in the substratum, and very slow in the dense glacial till. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Water is perched above the dense glacial till from November through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, western white pine, and Alaska cedar. The common forest understory plants are common beargrass, longtube twinflower, western brackenfern, evergreen blackberry, black mountain

huckleberry, prince's pine, and tall blue huckleberry.

On the basis of a 100-year site curve, the mean site index is 124 for western hemlock and is estimated to be 117 for Douglas fir. On the basis of a 50-year site curve, it is 86 for western hemlock and is estimated to be 90 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 188 cubic feet per acre per year, occurring at age 50. For Douglas fir it is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting Douglas fir, noble fir, or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and western hemlock occurs periodically. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass VIe.

32—Cayuse sandy loam, 8 to 30 percent slopes.

This very deep, well drained soil is on mountain back slopes and ridge crests. It formed in volcanic ash and

pumice over residuum and colluvium derived dominantly from andesite and basalt. The native vegetation is mainly conifers and shrubs. Elevation is 5,000 to 6,200 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 38 degrees F. The average frost-free period is about 95 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 0.25 inch thick. The upper 4 inches of the surface layer is very dark grayish brown sandy loam. The lower 9 inches is dark brown sandy loam. The upper 17 inches of the subsoil is brown loam. The lower 6 inches is dark yellowish brown gravelly loam. The substratum to a depth of 60 inches is variegated dark yellowish brown and yellowish brown very gravelly loam. In some areas the surface layer is loamy sand. In other areas the soil has 15 to 35 percent rock fragments in the lower part of the subsoil and the substratum.

Included in this unit are small areas of soils that have more than 35 percent rock fragments throughout. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Cayuse soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are subalpine fir and Engelmann spruce. The common forest understory plants are fawnlily, wild ginger, roughfruit berry, tall blue huckleberry, oneleaf foamflower, bunchberry dogwood, and lambstongue fawnlily.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 77. On the basis of a 50-year site curve, it is estimated to be 55. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 84 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through June. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft

when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir occurs periodically. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit.

This unit is in capability subclass VIe.

33—Cayuse sandy loam, 30 to 65 percent slopes.

This very deep, well drained soil is on mountain back slopes and ridge crests. It formed in volcanic ash and pumice over residuum and colluvium derived dominantly from andesite and basalt. The native vegetation is mainly conifers and shrubs. Elevation is 5,000 to 6,200 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 38 degrees F. The average frost-free period is about 95 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 0.25 inch thick. The upper 4 inches of the surface layer is very dark grayish brown sandy loam. The lower 9 inches is dark brown sandy loam. The upper 17 inches of the subsoil is brown loam. The lower 6 inches is dark yellowish brown gravelly loam. The substratum to a depth of 60 inches is variegated dark yellowish brown and yellowish brown very gravelly loam. In some areas the surface layer is loamy sand. In other areas the soil has 15 to 35 percent rock fragments in the lower part of the subsoil and the substratum.

Included in this unit are small areas of soils that have more than 35 percent rock fragments throughout. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Cayuse soil.

Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are subalpine fir and Engelmann spruce. The common forest understory plants are fawnlily, wild ginger, roughfruit berry, tall blue huckleberry, oneleaf foamflower, bunchberry dogwood, and lambstongue fawnlily.

On the basis of a 100-year site curve, the mean site index for western hemlock is 77. On the basis of a 50-year site curve, it is 55. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 84 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through June. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir or western hemlock

seedlings. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir occurs periodically. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit.

This unit is in capability subclass VIIe.

34—Chinkmin sandy loam, 0 to 15 percent slopes.

This moderately well drained soil is in cirques, in valleys, and on lateral moraines and drift plains in mountains. It is moderately deep to ortstein. It formed in a thin mantle of volcanic ash or pumice over colluvium derived from dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 6,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 90 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown sandy loam. The upper 7 inches of the subsoil is variegated strong brown and reddish brown gravelly loam. The next 7 inches is brown very cobbly loam. The lower part is dark yellowish brown very gravelly sandy loam 10 inches thick. Ortstein is at a depth of about 32 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loamy sand or loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, is 40 to 60 inches deep to ortstein, or has a less developed subsoil.

Included in this unit are small areas of Haywire, Nimue, and Serene soils, organic soils in depressions, and Chinkmin soils that have slopes of more than 15 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Chinkmin soil and very slow in the ortstein. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through July. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Alaska cedar, and mountain hemlock. The common forest understory plants are tall blue huckleberry, common beargrass, rusty menziesia, Oregongrape, brackenfern, currant, and Sitka mountainash.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 88. On the

basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 102 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock, subalpine fir, and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

35—Chinkmin sandy loam, 15 to 30 percent slopes. This moderately well drained soil is in cirques, in valleys, and on lateral moraines and drift plains in mountains. It is moderately deep to ortstein. It formed in a thin mantle of volcanic ash or pumice over colluvium derived from dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 6,000 feet. The average annual precipitation is about 100

inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 90 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown sandy loam. The upper 7 inches of the subsoil is variegated strong brown and reddish brown gravelly loam. The next 7 inches is brown very cobbly loam. The lower part is dark yellowish brown very gravelly sandy loam 10 inches thick. Ortstein is at a depth of about 32 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loamy sand or loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, is 40 to 60 inches deep to ortstein, or has a less developed subsoil.

Included in this unit are small areas of Haywire, Nimue, and Serene soils, slump areas, organic soils in depressions, and Chinkmin soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Chinkmin soil and very slow in the ortstein. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through July. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Alaska cedar, and mountain hemlock. The common forest understory plants are tall blue huckleberry, common beargrass, rusty menziesia, Oregongrape, brackenfern, currant, and Sitka mountainash.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 88. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 102 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and

slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock, subalpine fir, and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

36—Chinkmin sandy loam, 30 to 65 percent slopes. This moderately well drained soil is in cirques, in valleys, and on lateral moraines and drift plains in mountains. It is moderately deep to ortstein. It formed in a thin mantle of volcanic ash or pumice over colluvium derived from dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 6,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 90 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown sandy loam. The upper 7 inches of the subsoil is variegated strong brown and reddish brown gravelly loam. The next 7 inches is brown very cobbly loam. The lower part is dark yellowish brown very gravelly sandy loam 10 inches thick. Ortstein is at a depth of about 32 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loamy sand or loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, is 40 to 60 inches deep to ortstein, or has a less developed subsoil.

Included in this unit are small areas of Haywire, Nimue, and Serene soils, slump areas, organic soils in depressions, and Chinkmin soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Chinkmin soil and very slow in the ortstein. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through July. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Alaska cedar, and mountain hemlock. The common forest understory plants are tall blue huckleberry, common beargrass, rusty menziesia, Oregongrape, brackenfern, currant, and Sitka mountainash.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 88. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 102 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be

expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock, subalpine fir, and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass Vllc.

37—Chinkmin sandy loam, cold, 0 to 15 percent slopes. This moderately well drained soil is in cirques, in valleys, and on lateral moraines and drift plains in mountains. It is moderately deep to ortstein. It formed in a thin mantle of volcanic ash or pumice over colluvium derived from dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 4,500 to 6,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 90 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown sandy loam. The upper 7 inches of the subsoil is variegated strong brown and reddish brown gravelly loam. The next 7 inches is brown very cobbly loam. The lower part is dark yellowish brown very gravelly sandy loam 10 inches thick. Ortstein is at a depth of about 32 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loamy sand or loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, is 40 to 60 inches deep to ortstein, or has a less developed subsoil.

Included in this unit are small areas of Haywire, Nimue, and Serene soils, organic soils in depressions, and Chinkmin soils that have slopes of more than 15 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Chinkmin soil and very slow in the ortstein. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from

November through July. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Alaska cedar, and mountain hemlock. The common forest understory plants are tall blue huckleberry, common beargrass, rusty menziesia, Oregon grape, brackenfern, currant, and Sitka mountainash.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 81. On the basis of a 50-year site curve, it is estimated to be 60. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 90 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through June. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by subalpine fir and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

38—Chinkmin sandy loam, cold, 15 to 30 percent slopes. This moderately well drained soil is in cirques, in valleys, and on lateral moraines and drift plains in mountains. It is moderately deep to ortstein. It formed in a thin mantle of volcanic ash or pumice over colluvium derived from dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 4,500 to 6,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 90 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown sandy loam. The upper 7 inches of the subsoil is variegated strong brown and reddish brown gravelly loam. The next 7 inches is brown very cobbly loam. The lower part is dark yellowish brown very gravelly sandy loam 10 inches thick. Ortstein is at a depth of about 32 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loamy sand or loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, is 40 to 60 inches deep to ortstein, or has a less developed subsoil.

Included in this unit are small areas of Haywire, Nimue, and Serene soils, slump areas, organic soils in depressions, and Chinkmin soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Chinkmin soil and very slow in the ortstein. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through July. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Alaska cedar, and mountain hemlock. The common forest understory plants are tall blue huckleberry, common beargrass, rusty menziesia, Oregon grape, brackenfern, currant, and Sitka mountainash.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 81. On the basis of a 50-year site curve, it is estimated to be 60. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 90 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through June. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by subalpine fir and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

39—Christoff sandy loam, 6 to 30 percent slopes.

This very deep, moderately well drained soil is on mountain side slopes and in slump areas. It formed in volcanic ash and cinders over weathered breccia and tuffaceous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 6 inches, the surface layer is brown sandy loam. The upper 6 inches of the subsurface layer also is brown sandy loam. The lower 14 inches is dark

yellowish brown loam. The upper 16 inches of the subsoil also is dark yellowish brown loam. The lower part to a depth of 60 inches is brown clay loam. In some areas the surface layer is loam or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in part of the subsoil.

Included in this unit are small areas of Littlejohn, Ogarty, and Pitcher soils, poorly drained mineral soils in depressions, and Christoff soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Christoff soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a depth of 2.5 to 4.0 feet from December through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are western swordfern, Oregongrape, salal, red huckleberry, trillium, creambush oceanspray, vine maple, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 143. On the basis of a 50-year site curve, it is 106. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished

by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

40—Christoff sandy loam, 30 to 65 percent slopes.

This very deep, moderately well drained soil is on mountain side slopes and in slump areas. It formed in volcanic ash and cinders over weathered breccia and tuffaceous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 6 inches, the surface layer is brown sandy loam. The upper 6 inches of the subsurface layer also is brown sandy loam. The lower 14 inches is dark yellowish brown loam. The upper 16 inches of the subsoil also is dark yellowish brown loam. The lower part to a depth of 60 inches is brown clay loam. In some areas the surface layer is loam or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in part of the subsoil.

Included in this unit are small areas of Littlejohn, Ogarty, and Pitcher soils and Christoff soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Christoff soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a depth of 2.5 to 4.0 feet from December through April. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are western swordfern, Oregongrape, salal, red huckleberry, trillium, creambush oceanspray, vine maple, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 143. On the basis of a 50-year site curve, it is 106. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

41—Chuckanut loam, 6 to 15 percent slopes. This deep, well drained soil is on toe slopes in the foothills. It formed in a mixture of volcanic ash and colluvium derived from sandstone and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 400 to 1,500 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 49 degrees F. The average frost-free period is about 180 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. The surface layer is dark brown loam 8 inches thick. The upper 9 inches of the subsoil is dark yellowish brown gravelly

loam. The next 18 inches is pale brown gravelly sandy loam and dark brown gravelly loam. The lower 10 inches is light brownish gray gravelly loam. The substratum is light gray gravelly sandy loam 5 inches thick. Sandstone is at a depth of about 50 inches. The depth to sandstone ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam or sandy loam. In other areas the soil has a nongravelly subsoil or is more than 60 inches deep to sandstone.

Included in this unit are small areas of Alderwood, Beausite, and Tokul soils, soils that are 20 to 40 inches deep to sandstone, and Chuckanut soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Chuckanut soil. Available water capacity is moderate or high. The effective rooting depth is 40 to 60 inches. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used for pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used mainly as woodland. It also is suitable as pasture and hayland.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are salal, western brackenfern, western swordfern, Oregongrape, red huckleberry, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 171. On the basis of a 50-year site curve, it is 128. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 182 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover

areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

42—Chuckanut loam, 15 to 30 percent slopes. This deep, well drained soil is on toe slopes and back slopes in the foothills. It formed in a mixture of volcanic ash and colluvium derived from sandstone and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 400 to 1,500 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 49 degrees F. The average frost-free period is about 180 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. The surface layer is dark brown loam 8 inches thick. The upper 9 inches of the subsoil is dark yellowish brown gravelly loam. The next 18 inches is pale brown gravelly sandy loam and dark brown gravelly loam. The lower 10 inches is light brownish gray gravelly loam. The substratum is light gray gravelly loam 5 inches thick. Sandstone is at a depth of about 50 inches. The depth to sandstone ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam or sandy loam. In other areas the soil has a nongravelly subsoil or is more than 60 inches deep to sandstone.

Included in this unit are small areas of Alderwood, Beausite, and Tokul soils, soils that are 20 to 40 inches deep to sandstone, and Chuckanut soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Chuckanut soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are salal, western brackenfern, western swordfern, Oregongrape, red huckleberry, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 171. On the basis of a 50-year site curve, it is 128. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 182 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet

causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

43—Chuckanut loam, 30 to 65 percent slopes. This deep, well drained soil is on back slopes in the foothills. It formed in a mixture of volcanic ash and colluvium derived from sandstone and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 400 to 1,500 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 49 degrees F. The average frost-free period is about 180 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. The surface layer is dark brown loam 8 inches thick. The upper 9 inches of the subsoil is dark yellowish brown gravelly loam. The next 18 inches is pale brown gravelly sandy loam and dark brown gravelly loam. The lower 10 inches is light brownish gray gravelly loam. The substratum is light gray gravelly loam 5 inches thick. Sandstone is at a depth of about 50 inches. The depth to sandstone ranges from 40 to 60 inches. In some areas the surface layer is gravelly loam or sandy loam. In other areas the soil has a nongravelly subsoil or is more than 60 inches deep to sandstone.

Included in this unit are small areas of Alderwood, Beausite, and Tokul soils, soils that are 20 to 40 inches deep to sandstone, and Chuckanut soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Chuckanut soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are salal, western brackenfern, western swordfern, Oregongrape, red huckleberry, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 171. On the basis of a 50-year site curve, it is 128. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 182 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

44—Cinebar silt loam, 6 to 15 percent slopes. This very deep, well drained soil is on toe slopes in the foothills. It formed in loess and slope alluvium high in content of volcanic ash. The native vegetation is mainly

conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 175 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and moss 2 inches thick. The surface layer is dark brown silt loam 10 inches thick. The next 8 inches also is dark brown silt loam. The subsoil is yellowish brown silt loam 36 inches thick. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the surface layer is loam. In other areas the soil has strata of sandy material in the subsoil.

Included in this unit are small areas of Klaber, Mashel, Scamman, and Wilkeson soils and Cinebar soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Cinebar soil. Available water capacity is high. The effective rooting depth is 60 inches. In most areas, runoff is slow and the hazard of water erosion is slight. In the areas used as pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used as woodland. It also is suitable as pasture and hayland.

Douglas fir, red alder, and western hemlock are the main woodland species. Among the trees of limited extent are bigleaf maple and western redcedar. The common forest understory plants are western swordfern, Oregongrape, red huckleberry, salal, trillium, devilsclub, vine maple, and oxalis.

On the basis of a 100-year site curve, the mean site index is 174 for Douglas fir and 155 for western hemlock. On the basis of a 50-year site curve, it is 132 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 185 cubic feet per acre per year, occurring at age 60. For western hemlock it is 246 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of red alder have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a

high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

45—Cinebar silt loam, 15 to 30 percent slopes.

This very deep, well drained soil is on toe slopes in the foothills. It formed in loess and slope alluvium high in content of volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 175 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and moss 2 inches thick. The surface layer is dark brown silt loam 10 inches thick. The next 8 inches also is dark brown silt loam. The subsoil is yellowish brown silt loam 36 inches thick. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the surface layer is loam. In other areas the soil has strata of sandy material in the subsoil.

Included in this unit are small areas of Mashel, Scamman, and Wilkeson soils and Cinebar soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Cinebar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir, red alder, and western hemlock are the main woodland species. Among the trees of limited extent are bigleaf maple and western redcedar. The common forest understory plants are western swordfern, Oregongrape, red huckleberry, salal, trillium, devilsclub, vine maple, and oxalis.

On the basis of a 100-year site curve, the mean site

index is 174 for Douglas fir and 155 for western hemlock. On the basis of a 50-year site curve, it is 132 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 185 cubic feet per acre per year, occurring at age 60. For western hemlock it is 246 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of red alder have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

46—Cinebar silt loam, 30 to 45 percent slopes.

This very deep, well drained soil is on back slopes in the foothills. It formed in loess and slope alluvium high in content of volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 175 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and moss 2 inches thick. The

surface layer is dark brown silt loam 10 inches thick. The next 8 inches also is dark brown silt loam. The subsoil is yellowish brown silt loam 36 inches thick. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the surface layer is loam. In other areas the soil has strata of sandy material in the subsoil.

Included in this unit are small areas of Mashel, Scamman, and Wilkeson soils and Cinebar soils that have slopes of more than 45 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Cinebar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir, red alder, and western hemlock are the main woodland species. Among the trees of limited extent are bigleaf maple and western redcedar. The common forest understory plants are western swordfern, Oregongrape, red huckleberry, salal, trillium, devilsclub, vine maple, and oxalis.

On the basis of a 100-year site curve, the mean site index is 174 for Douglas fir and 155 for western hemlock. On the basis of a 50-year site curve, it is 132 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 185 cubic feet per acre per year, occurring at age 60. For western hemlock it is 246 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of red alder have not been made.

The main limitation affecting timber harvesting is the slope. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Establishing a plant cover in these disturbed areas reduces the hazard of erosion.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective

plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

47—Cotteral very cindery sandy loam, 8 to 30 percent slopes. This very deep, well drained soil is on mountain back slopes and ridges. It formed in volcanic ash and weathered cinders. The native vegetation is mainly conifers and shrubs. Elevation is 2,800 to 3,600 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 125 days.

Typically, the surface is covered with a mat of needles, twigs, moss, and rotted wood 3 inches thick. When mixed to a depth of 9 inches, the surface layer is reddish brown very cindery sandy loam. The upper part of the subsoil is dark brown and strong brown very cindery sand 23 inches thick. The lower part to a depth of 60 inches is dark yellowish brown silt loam. In some areas the surface layer is very cindery loamy sand or cindery sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, is 20 to 60 inches deep to dense glacial till, or is 40 to 60 inches deep to sandstone or andesite.

Included in this unit are small areas of Cattcreek and Ethania soils and Cotteral soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Cotteral soil. Available water capacity is moderate or high. The effective rooting depth is 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are western redcedar, noble fir, Alaska cedar, and western white pine. The common forest understory plants are western swordfern, vine maple, Oregongrape, red huckleberry, western brackenfern, and common beargrass.

On the basis of a 100-year site curve, the mean site index is estimated to be 120 for western hemlock and

117 for Douglas fir. On the basis of a 50-year site curve, it is estimated to be 85 for western hemlock and 90 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 180 cubic feet per acre per year, occurring at age 50. For Douglas fir it is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting Douglas fir, noble fir, western hemlock, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass VIe.

48—Cotteral very cindery sandy loam, cold, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes and ridges. It formed in volcanic ash and weathered cinders. The native vegetation is mainly conifers and shrubs. Elevation is 3,600 to 4,900 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 125 days.

Typically, the surface is covered with a mat of needles, twigs, moss, and rotted wood 3 inches thick. When mixed to a depth of 6 inches, the surface layer is reddish brown very cindery sandy loam. The upper 8 inches of the subsoil is strong brown very cindery loamy sand. The next 5 inches is dark reddish brown and dark yellowish brown sandy loam. The lower part to a depth of 60 inches is light olive brown sandy loam. In some areas the surface layer is very cindery loamy sand or cindery sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, is 20 to 60 inches deep to dense glacial till, or is 40 to 60 inches deep to sandstone.

Included in this unit are small areas of Cattcreek and Ethania soils and Cotteral soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Cotteral soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are western redcedar and noble fir. The common forest understory plants are western swordfern, vine maple, Oregongrape, red huckleberry, western brackenfern, and common beargrass.

On the basis of a 100-year site curve, the mean site index for western hemlock is 88. On the basis of a 50-year site curve, it is 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 102 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit.

Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir, western hemlock, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass VIIe.

49—Crinker very channery loam, 30 to 65 percent slopes. This well drained soil is on glacially modified mountain back slopes and shoulder slopes. It is moderately deep to weathered bedrock. It formed in a mixture of glacial till, volcanic ash, and colluvium and slope alluvium derived dominantly from phyllite. The colluvium is modified slightly by glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 2,600 to 3,600 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 5 inches thick. When mixed to a depth of 5 inches, the surface layer is

dark brown very channery loam. The subsoil is dark yellowish brown extremely channery loam 17 inches thick. The substratum is dark grayish brown extremely channery loam 10 inches thick. Phyllite is at a depth of about 32 inches. The depth to phyllite ranges from 20 to 40 inches. In some areas the surface layer is channery silt loam or channery loam. In other areas the soil has a less developed subsoil or is 14 to 20 or 40 to 60 inches deep to phyllite.

Included in this unit are small areas of Altapeak, Hinker, Klapatche, Playco, and Serene soils, soils that are 20 to 40 inches deep to dense glacial till, Rock outcrop, and Crinker soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Crinker soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock is the main woodland species. Among the trees of limited extent is Pacific silver fir. The common forest understory plants are tall blue huckleberry, salmonberry, bunchberry dogwood, western brackenfern, and deer fern.

On the basis of a 100-year site curve, the mean site index for western hemlock is 119. On the basis of a 50-year site curve, it is 83. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 178 cubic feet per acre per year, occurring at age 50. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality phyllite. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil

is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock, noble fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

50—Cryofluvents, 0 to 8 percent slopes. These deep, well drained soils are in mountain valleys. They formed in alluvium over andesite. The native vegetation is mainly conifers and shrubs. Elevation is 2,800 to 3,500 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 38 degrees F. The average frost-free period is about 100 days.

No single profile is representative of these soils. One of the more commonly observed ones, however, is covered with a mat of needles, leaves, and twigs about 4 inches thick. Typically, the surface layer is dark brown stony sandy loam 5 inches thick. The subsoil is dark yellowish brown gravelly loamy sand 4 inches thick. The upper 19 inches of the substratum is dark yellowish brown gravelly loamy sand and dark brown very gravelly loamy sand. The lower 21 inches is light olive brown very gravelly fine sand. Andesite is at a depth of about 49 inches. The depth to andesite ranges from 40 to 80 inches. The distribution of organic carbon varies with increasing depth. The subsoil and substratum are sandy or are sandy and stratified with grayish, low-

chroma, silty material. The content of rock fragments in the control section ranges from 25 to 45 percent by weighted average.

Included in this unit are small areas of organic soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Cryofluvents. Available water capacity is low. The effective rooting depth is more than 40 inches. Runoff is slow, and the hazard of water erosion is slight. The soils are subject to occasional, brief periods of flooding from December through May.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, Douglas fir, and Alaska cedar. The common forest understory plants are huckleberry, prince's pine, bunchberry dogwood, deer fern, and lupine.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 110. On the basis of a 50-year site curve, it is estimated to be 80. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 161 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soils are wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soils. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soils are moist and a moderate degree of puddling when the soils are wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be

accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir occurs readily.

This unit is in capability subclass VIw.

51—Cryochemists, 0 to 2 percent slopes. These very deep, very poorly drained soils are in depressions in mountain valleys and in cirques on mountains. They formed in a mixture of peat, muck, pumice, volcanic ash, and glacial till. The native vegetation is mainly shrubs and sedges. Elevation is 2,800 to 3,500 feet. The average annual precipitation is about 105 inches, and the average annual air temperature is about 41 degrees F. The average frost-free period is about 110 days.

No single profile is representative of these soils. In one of the more commonly observed ones, however, the surface layer is black muck about 6 inches thick. The upper 15 inches of the underlying material is very dark grayish brown hemic material. The next 7 inches is dark brown hemic material. The lower part to a depth of 60 inches is gray clay loam. The depth to mineral soil material ranges from 20 to more than 60 inches. After rubbing, the overall content of fiber ranges from 20 to 30 percent, although individual layers can have as much as 50 percent. Reaction is extremely acid or very strongly acid.

Included in this unit are small areas of ponded mineral soils. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Cryochemists. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at or above the surface from November through June. Runoff is ponded, and there is no hazard of erosion.

This unit is used for wildlife habitat. The native vegetation consists of sedges, willows, skunk cabbage, deer fern, and huckleberry.

This unit is in capability subclass VIIw.

52—Dobbs loam, 8 to 30 percent slopes. This moderately well drained soil is in cirque basins and on the adjacent mountain back slopes. It is moderately deep to dense glacial till. It formed in glacial till, volcanic ash, and colluvium. The native vegetation is mainly conifers and shrubs. Elevation is 2,000 to 3,200 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark brown loam 10 inches thick. The upper 18

inches of the subsoil is dark brown and dark yellowish brown very gravelly loam. The lower part is yellowish brown very gravelly loam 7 inches thick. Dark yellowish brown, dense glacial till that crushes to very gravelly sandy loam is below a depth of about 35 inches. The dense glacial till is similar to a cemented pan. The depth to dense glacial till ranges from 30 to 40 inches. In some areas the surface layer is gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil or is 40 to 60 inches deep to dense glacial till.

Included in this unit are small areas of Jonas, Littlejohn, Pheeney, and Pitcher soils and Dobbs soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Dobbs soil and very slow in the dense glacial till. Available water capacity is moderate. The effective rooting depth is 30 to 40 inches. Water is perched above the dense glacial till from November through March. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are Pacific silver fir and noble fir. The common forest understory plants are vine maple, Oregon grape, trailing blackberry, western swordfern, deer fern, and salal.

On the basis of a 100-year site curve, the mean site index is estimated to be 144 for Douglas fir and 140 for western hemlock. On the basis of a 50-year site curve, it is estimated to be 110 for Douglas fir and 100 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 150 cubic feet per acre per year, occurring at age 60. For western hemlock it is about 218 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is

moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock, Douglas fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the dense glacial till, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

53—Edgewick silt loam, 0 to 3 percent slopes. This very deep, well drained soil is on river terraces. It formed in alluvium. The native vegetation is mainly trees and shrubs. Elevation is 50 to 500 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 150 days.

Typically, the surface layer is very dark brown silt loam 8 inches thick. The subsoil is olive brown silt loam 12 inches thick. The upper 13 inches of the substratum is olive brown fine sandy loam. The next 13 inches is olive brown loamy sand. The lower part to a depth of 60 inches is dark grayish brown very gravelly sand. In some areas the surface layer is very fine sandy loam, loam, or fine sandy loam. In other areas, the soil is 20 to 40 inches deep to sand or the underlying material is stratified silt loam, fine sandy loam, and sand.

Included in this unit are small areas of Nooksack, Oridia, Salal, and Si soils. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Edgewick soil. Available water capacity also is moderate. The effective rooting depth is limited by a perched high water table, which is at a depth of 3 to 4 feet from February through April. This soil is subject to occasional, brief periods of flooding from November through March. Channeling and deposition are common along streambanks.

This unit is used for pasture, hay, and woodland. Proper stocking rates, pasture rotation, and restricted grazing during short wet periods help to keep the

pasture in good condition and help to control runoff and erosion. Grazing when the soil is wet results in compaction of the surface layer and poor tilth. If irrigated, this unit is suited to all of the crops commonly grown in the survey area.

Douglas fir and red alder are the main woodland species. Among the trees of limited extent is western redcedar. The common forest understory plants are trailing blackberry, salmonberry, western swordfern, red elderberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 167. On the basis of a 50-year site curve, it is estimated to be 125. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 178 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of red alder have not been made.

The main limitations affecting timber harvesting are the muddiness caused by seasonal wetness and occasional flooding. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and may be impassable during rainy periods. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. The seedling survival rate may be low where flooding occurs.

This unit is in capability subclass IIIw.

54—Elwell silt loam, 6 to 30 percent slopes. This moderately well drained soil is on mountain back slopes and plateaus. It is moderately deep to ortstein. It formed in glacial till that has an admixture of volcanic ash and loess. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,500 feet. The average

annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark yellowish brown silt loam 8 inches thick. The upper 8 inches of the subsoil also is dark yellowish brown silt loam. The lower 19 inches is dark brown and yellowish brown gravelly silt loam. Ortstein that crushes to gravelly silt loam is at a depth of about 35 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loam, gravelly loam, or gravelly silt loam. In other areas the soil has 35 to 50 percent rock fragments in the subsoil or is 40 to 60 inches deep to ortstein.

Included in this unit are small areas of Blethen, Skykomish, and Welcome soils and Elwell soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Elwell soil and very slow in the ortstein. Available water capacity is high. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through June. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are western redcedar, red alder, and bigleaf maple. The common forest understory plants are western swordfern, red huckleberry, western brackenfern, salal, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index is 149 for western hemlock and 165 for Douglas fir. On the basis of a 50-year site curve, it is 105 for western hemlock and 124 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 236 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 176 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully

laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock, Douglas fir, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

55—Elwell silt loam, 30 to 65 percent slopes. This moderately well drained soil is on mountain back slopes and plateaus. It is moderately deep to ortstein. It formed in glacial till with an admixture of volcanic ash and loess. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,500 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark yellowish brown silt loam 8 inches thick. The upper 8 inches of the subsoil also is dark yellowish brown silt loam. The lower 19 inches is dark brown and yellowish brown gravelly silt loam. Ortstein that crushes to gravelly silt loam is at a depth of 35 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loam, gravelly loam, or gravelly silt loam. In other areas the soil has 35 to 50 percent rock fragments in the subsoil or is 40 to 60 inches deep to ortstein.

Included in this unit are small areas of Blethen, Skykomish, and Welcome soils and Elwell soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Elwell soil and very slow in the ortstein. Available water capacity is high. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through June. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are western redcedar, red alder, and bigleaf maple. The common forest understory plants are western swordfern, red huckleberry, western brackenfern, salal, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index is 149 for western hemlock and 165 for Douglas fir. On the basis of a 50-year site curve, it is 105 for western hemlock and 124 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 236 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 176 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are occasional snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock, Douglas fir, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings.

Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

56—Ethanias very cindery loamy sand, 30 to 65 percent slopes. This very deep, well drained soil is on mountain ridge crests, on back slopes, and in cirque basins. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 37 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles, twigs, and bark 3 inches thick. When mixed to a depth of 7 inches, the surface layer is reddish brown very cindery loamy sand. The upper 24 inches of the subsoil is strong brown and yellowish red very cindery loamy sand. The lower part to a depth of 60 inches is dark brown very gravelly loam. In some areas the surface layer is very cindery sandy loam. In other areas the soil is 40 to 60 inches deep to andesite or sandstone or has 15 to 35 percent rock fragments in the substratum.

Included in this unit are small areas of Cottrell soils, soils that are 20 to 40 inches deep to andesite, and Ethanias soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very rapid in the upper part of the Ethanias soil and moderate in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are common beargrass, deer fern, common fireweed, huckleberry, pearly everlasting, and thimbleberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 95. On the basis of a 50-year site curve, it is estimated to be 70. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 113 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less

extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir, western hemlock, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and noble fir occurs periodically. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit.

This unit is in capability subclass VIIe.

57—Ethanias very cindery loamy sand, 65 to 90 percent slopes. This very deep, well drained soil is on mountain ridge crests, on back slopes, and in cirque basins. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 37 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles, twigs, and bark 3 inches thick. When mixed to a depth of 7 inches, the surface layer is reddish brown very cindery loamy sand. The upper 24 inches of the subsoil is strong brown and yellowish red very cindery loamy sand. The lower part to a depth of 60 inches is dark brown very gravelly loam. In some areas the

surface layer is very cindery sandy loam. In other areas the soil is 40 to 60 inches deep to andesite or sandstone or has 15 to 35 percent rock fragments in the substratum.

Included in this unit are small areas of Cottoral soils, soils that are 20 to 40 inches deep to andesite, and Ethania soils that have slopes of less than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very rapid in the upper part of the Ethania soil and moderate in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are common beargrass, deer fern, common fireweed, huckleberry, pearly everlasting, and thimbleberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 95. On the basis of a 50-year site curve, it is estimated to be 70. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 113 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is

dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting noble fir, western hemlock, or Pacific silver fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and noble fir occurs periodically.

This unit is in capability subclass VIIe.

58—Ethania very cindery loamy sand, sandstone substratum, 30 to 65 percent slopes. This very deep, well drained soil is on mountain ridge crests, on back slopes, and in cirque basins. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from sandstone. The native vegetation is mainly conifers and shrubs. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 37 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles, twigs, and bark 1 inch thick. When mixed to a depth of 6 inches, the surface layer is reddish brown very cindery loamy sand. The upper 8 inches of the subsoil is strong brown very cindery loamy sand. The next 22 inches is dark yellowish brown very gravelly loam and very gravelly sandy loam. The lower part to a depth of 60 inches is olive brown extremely cobbly loamy sand. In some areas the surface layer is very cindery sandy loam. In other areas the soil is 40 to 60 inches deep to sandstone or andesite or has 15 to 35 percent rock fragments in the substratum.

Included in this unit are small areas of Cottoral soils, soils that are 20 to 40 inches deep to sandstone, and Ethania soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Ethania soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium,

and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are common beargrass, deer fern, common fireweed, huckleberry, pearly everlasting, and thimbleberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 95. On the basis of a 50-year site curve, it is estimated to be 70. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 113 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. The seedling mortality

rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting noble fir, western hemlock, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and noble fir occurs periodically.

This unit is in capability subclass VIIe.

59—Ethania very cindery loamy sand, sandstone substratum, 65 to 90 percent slopes. This very deep, well drained soil is on mountain ridge crests, on back slopes, and in cirque basins. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from sandstone. The native vegetation is mainly conifers and shrubs. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 37 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles, twigs, and bark 1 inch thick. When mixed to a depth of 6 inches, the surface layer is reddish brown very cindery loamy sand. The upper 8 inches of the subsoil is strong brown very cindery loamy sand. The next 22 inches is dark yellowish brown very gravelly loam and very gravelly sandy loam. The lower part to a depth of 60 inches is olive brown extremely cobbly loamy sand. In some areas the surface layer is very cindery sandy loam. In other areas the soil is 40 to 60 inches deep to sandstone or andesite or has 15 to 35 percent rock fragments in the substratum.

Included in this unit are small areas of Cotteral soils, soils that are 20 to 40 inches deep to sandstone, and Ethania soils that have slopes of less than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Ethania soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are common beargrass, deer fern, common fireweed, huckleberry, pearly everlasting, and thimbleberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 95. On the basis of a 50-year site curve, it is estimated to be 70. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 113 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not

been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting noble fir, western hemlock, or Pacific silver fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and noble fir occurs periodically.

This unit is in capability subclass VIIe.

60—Ethanias very cindery loamy sand, till substratum, 8 to 30 percent slopes. This deep, well drained soil is on mountain crests, on back slopes, and in cirques basins. It formed in dacitic pumice and

volcanic ash over colluvium and slope alluvium derived from glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 3,500 to 5,200 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 37 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. When mixed to a depth of 8 inches, the surface layer is reddish brown very cindery loamy sand. The upper 7 inches of the subsoil is strong brown very cindery coarse sand. The lower 26 inches is yellowish red and dark brown very gravelly loam. Dark yellowish brown, dense glacial till that crushes to very gravelly loam is at a depth of 41 inches. The dense glacial till is similar to a cemented pan. The depth to dense glacial till ranges from 40 to 60 inches. In some areas the surface layer is cindery loamy sand. In other areas the soil is more than 60 inches deep to dense glacial till or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Cottrell soils, soils that are 20 to 40 inches deep to dense glacial till or bedrock, and Ethanias soils that have slopes of more than 30 percent or less than 8 percent.

Permeability is moderate in the Ethanias soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Water is perched above the dense glacial till from November through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are common beargrass, deer fern, common fireweed, huckleberry, pearly everlasting, and thimbleberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 95. On the basis of a 50-year site curve, it is estimated to be 70. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 113 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer

after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir, western hemlock, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and noble fir occurs periodically.

This unit is in capability subclass VIs.

61—Foss stony sandy loam, 8 to 30 percent slopes. This very deep, well drained soil is on the interior side slopes of cirque basins, on broad ridge crests, and on benches. It formed in volcanic ash and pumice over residuum and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface layer is very dark brown stony sandy loam 4 inches thick. The upper 12 inches of the subsoil is yellowish brown and strong brown gravelly sandy loam. The next 32 inches is dark brown very cobbly silt loam and dark reddish brown very gravelly silt loam. The lower part to a depth of 60 inches is dark reddish brown very gravelly silt loam. In some areas the surface layer is gravelly loam or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the lower part of the subsoil and in the substratum.

Included in this unit are small areas of Haywire and Nagrom soils and Foss soils that have slopes of more

than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Foss soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Douglas fir. The common forest understory plants are common beargrass, evergreen huckleberry, western rattlesnake plantain, princes pine, and queencup beadlily.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 95. On the basis of a 50-year site curve, it is estimated to be 70. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 113 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are snowpack and the stones on the surface. The stones can hinder yarding. When felled, the timber can break on the stones. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Seedling mortality and establishment are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are

subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting noble fir or western hemlock seedlings. Because of the stones on the surface, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIe.

62—Foss stony sandy loam, 30 to 65 percent slopes. This very deep, well drained soil is on the interior back slopes of cirque basins, on broad ridge crests, and on benches. It formed in volcanic ash and pumice over residuum and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface layer is very dark brown stony sandy loam 4 inches thick. The upper 12 inches of the subsoil is yellowish brown and strong brown gravelly sandy loam. The next 32 inches is dark brown very cobbly silt loam and dark reddish brown very gravelly silt loam. The lower part to a depth of 60 inches is dark reddish brown very gravelly silt loam. In some areas the surface layer is gravelly loam or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the lower part of the subsoil and in the substratum.

Included in this unit are small areas of Haywire and Nagrom soils and Foss soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Foss soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Douglas fir. The common forest understory plants are common beargrass, evergreen huckleberry, western rattlesnake plantain, prince's pine, and queencup beadlily.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 95. On the basis of a 50-year site curve, it is estimated to be 70. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 113 cubic feet per acre per year, occurring at age 60. Estimates of the

site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, snowpack, the stones on the surface, and the hazard of erosion. The stones can hinder yarding. When felled, the timber can break on the stones. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality and establishment are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting noble fir or western hemlock seedlings. Because of the stones on the surface, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

63—Gallup loam, 6 to 30 percent slopes. This very deep, well drained soil is on glacially modified mountain ridgetops and back slopes. It formed in volcanic ash and weathered metasediments. The native vegetation is mainly conifers and shrubs. Elevation is 2,700 to 3,600 feet. The average annual precipitation is about 95 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown loam. The upper 9 inches of the subsoil is strong brown gravelly loam. The lower 27 inches is yellowish brown and brownish yellow gravelly loam. The substratum to a depth of 60 inches is dark yellowish brown gravelly loam. In some areas the surface layer is sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil.

Included in this unit are small areas of Chinkmin, Haywire, Nagrom, Nimue, and Playco soils and Gallup soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Gallup soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is Douglas fir. The common forest understory plants are deer fern, huckleberry, common beargrass, and salal.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 101. On the basis of a 50-year site curve, it is estimated to be 75. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the

available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality and establishment are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of western hemlock seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIs.

64—Gallup loam, 30 to 65 percent slopes. This very deep, well drained soil is on glacially modified mountain ridgetops and back slopes. It formed in volcanic ash and weathered metasediments. The native vegetation is mainly conifers and shrubs. Elevation is 2,700 to 3,600 feet. The average annual precipitation is about 95 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown loam. The upper 9 inches of the subsoil is strong brown gravelly loam. The lower 27 inches is yellowish brown and brownish yellow gravelly loam. The substratum to a depth of 60 inches is dark yellowish brown gravelly loam. In some areas the surface layer is sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil.

Included in this unit are small areas of Chinkmin, Haywire, Nagrom, and Nimue soils and Gallup soils that

have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Gallup soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is Douglas fir. The common forest understory plants are deer fern, huckleberry, common beargrass, and salal.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 101. On the basis of a 50-year site curve, it is estimated to be 75. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality and establishment are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The

seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of western hemlock seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

65—Gallup loam, breccia substratum, 30 to 65 percent slopes. This very deep, well drained soil is on glacially modified mountain ridgetops and shoulder slopes. It formed in volcanic ash and in colluvium derived dominantly from volcanic breccia. The native vegetation is mainly conifers and shrubs. Elevation is 2,800 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 95 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 2 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown loam. The upper 8 inches of the subsoil also is dark reddish brown loam. The next 8 inches is dark brown loam. The lower 13 inches is dark yellowish brown gravelly loam. The upper 13 inches of the substratum is dark yellowish brown gravelly sandy loam. The lower part to a depth of 60 inches is dark yellowish brown gravelly loam. In some areas the surface layer is silt loam.

Included in this unit are small areas of Hartnit, Klapatche, Nagrom, Playco, and Stahl soils, soils that have 35 to 60 percent rock fragments throughout, and Gallup soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Gallup soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is Douglas fir. The common forest understory plants are red huckleberry, blueleaved huckleberry, bunchberry dogwood, trailing blackberry, deer fern, longtube twinflower, Oregongrape, vine maple, and salal.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 101. On the basis of a 50-year site curve, it is estimated to be

75. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. In areas that have slopes of less than 30 percent, wheeled and tracked equipment can be used. If this equipment is used when the soil is wet, excessive rutting can result. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality and establishment are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing

plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

66—Getchell loam, 6 to 15 percent slopes. This moderately well drained soil is on glacially modified mountain back slopes and plateaus. It is moderately deep to ortstein. It formed in volcanic ash, colluvium, and dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 105 days.

Typically, the surface is covered with a mat of needles and twigs 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown loam. The upper 5 inches of the subsoil also is dark reddish brown loam. The next 7 inches is dark brown loam. The lower 11 inches is light yellowish brown gravelly loam. Light olive brown ortstein is at a depth of about 30 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is silt loam, sandy loam, or gravelly loam. In other areas the soil has a gravelly subsoil, is 40 to 60 inches deep to ortstein, has more than 6 percent organic carbon in the upper part of the subsoil, or has a less developed subsoil.

Included in this unit are small areas of Chinkmin, Hartnit, Kindy, and Playco soils, soils that are less than 20 inches deep to dense glacial till, poorly drained soils in depressions, and Getchell soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Getchell soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock is the main woodland species. Among the trees of limited extent are Pacific silver fir, Douglas fir, and western redcedar. The common forest understory plants are red huckleberry, deer fern, western brackenfern, devilsclub, ladyfern, and bunchberry dogwood.

On the basis of a 100-year site curve, the mean site index for western hemlock is 129. On the basis of a 50-year site curve, it is 91. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 198 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from December through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock, Douglas fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

67—Getchell loam, 15 to 30 percent slopes. This moderately well drained soil is on glacially modified mountain back slopes and plateaus. It is moderately deep to ortstein. It formed in volcanic ash, colluvium, and dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 105 days.

Typically, the surface is covered with a mat of needles and twigs 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark gray and black loam. The upper 5 inches of the subsoil is dark reddish brown loam. The next 7 inches is dark brown loam. The lower 11 inches is light yellowish brown gravelly loam. Light olive brown ortstein is at a depth of

about 30 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is silt loam, sandy loam, or gravelly loam. In other areas the soil has a gravelly subsoil, is 40 to 60 inches deep to ortstein, has more than 6 percent organic carbon in the upper part of the subsoil, or has a less developed subsoil.

Included in this unit are small areas of Chinkmin, Hartnit, Kindy, and Playco soils, soils that are less than 20 inches deep to dense glacial till, and Getchell soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Getchell soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock is the main woodland species. Among the trees of limited extent are Pacific silver fir, Douglas fir, and western redcedar. The common forest understory plants are red huckleberry, deer fern, western brackenfern, devilsclub, ladyfern, and bunchberry dogwood.

On the basis of a 100-year site curve, the mean site index for western hemlock is 129. On the basis of a 50-year site curve, it is 91. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 198 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from December through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock, Douglas fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

68—Getchell loam, 30 to 65 percent slopes. This moderately well drained soil is on glacially modified mountain back slopes and plateaus. It is moderately deep to ortstein. It formed in volcanic ash, colluvium, and dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 3,000 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 105 days.

Typically, the surface is covered with a mat of needles and twigs 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark gray and black loam. The upper 5 inches of the subsoil is dark reddish brown loam. The next 7 inches is dark brown loam. The lower 11 inches is light yellowish brown gravelly loam. Light olive brown ortstein is at a depth of about 30 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is silt loam, sandy loam, or gravelly loam. In other areas the soil has a gravelly subsoil, is 40 to 60 inches deep to ortstein, has more than 6 percent organic carbon in the upper part of the subsoil, or has a less developed subsoil.

Included in this unit are small areas of Chinkmin, Hartnit, Kindy, and Playco soils, soils that are less than 20 inches deep to dense glacial till, and Getchell soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Getchell soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through April. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock is

the main woodland species. Among the trees of limited extent are Pacific silver fir, Douglas fir, and western redcedar. The common forest understory plants are red huckleberry, deer fern, western brackenfern, devilsclub, ladyfern, and bunchberry dogwood.

On the basis of a 100-year site curve, the mean site index for western hemlock is 129. On the basis of a 50-year site curve, it is 91. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 198 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from December through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock, Douglas fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

69—Greenwater loamy sand, 0 to 8 percent slopes.

This very deep, somewhat excessively drained soil is on terraces. It formed in alluvium derived dominantly from pumice and andesite. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 49 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of needles, twigs, leaves, and moss 3 inches thick. The surface layer is very dark brown loamy sand 5 inches thick. The subsoil is dark brown loamy sand 12 inches thick. The upper 34 inches of the substratum is dark grayish brown sand and dark gray sand and coarse sand. The lower part to a depth of 60 inches is dark gray very gravelly coarse sand. In some areas the soil has 0 to 35 percent rock fragments in the lower part of the substratum or does not have pumice.

Included in this unit are small areas of Grotto, Snoqualmie, and Winston soils and Greenwater soils that have slopes of more than 8 percent. Included areas make up about 20 percent of the total acreage.

Permeability is rapid in the Greenwater soil. Available water capacity is low. The effective rooting depth is 60 inches or more. This soil is subject to rare flooding. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used as pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used as woodland. If irrigated, it also is suitable as pasture and hayland.

Douglas fir, western hemlock, and red alder are the main woodland species. Among the trees of limited extent are western redcedar and bigleaf maple. The common forest understory plants are creambush, oceanspray, western brackenfern, Oregon grape, salal, western swordfern, trailing blackberry, red huckleberry, and rose.

On the basis of a 100-year site curve, the mean site index is 152 for Douglas fir and 164 for western hemlock. On the basis of a 50-year site curve, it is 117 for Douglas fir and 114 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 161 cubic feet per acre per year, occurring at age 60. For western hemlock it is 262 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of red alder have not been made.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting

during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVs.

70—Grotto gravelly loamy sand, 0 to 8 percent slopes. This very deep, somewhat excessively drained soil is on river terraces. It formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, bark, and twigs 2 inches thick. The surface layer is brown gravelly loamy sand 5 inches thick. The upper 14 inches of the subsoil is dark brown very gravelly coarse sand. The lower 17 inches is brown and strong brown very gravelly coarse sand. The substratum to a depth of 60 inches is yellowish brown very gravelly sand. In some areas the surface layer is loamy sand. In other areas the soil has 0 to 35 percent rock fragments in the subsoil or has a subsoil and substratum of sandy loam.

Included in this unit are small areas of Snoqualmie soils and Grotto soils that have slopes of more than 8 percent. Included areas make up about 20 percent of the total acreage.

Permeability is rapid in the Grotto soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to rare flooding.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species.

Among the trees of limited extent are red alder and western redcedar. The common forest understory plants are salal, Oregongrape, red huckleberry, vine maple, western swordfern, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 123. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 119 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and establishment are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVs.

71—Hartnit silt loam, 8 to 30 percent slopes. This well drained soil is on glacially modified mountain ridgetops and back slopes. It is moderately deep to bedrock. It formed in glacial till, volcanic ash, and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 2,800 to 3,600 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 95 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 7 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown silt loam. The subsoil is dark brown and dark yellowish brown gravelly silt loam 14 inches thick. The substratum is dark yellowish brown very gravelly silt loam 11 inches thick. Andesite is at a depth of about 31 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is gravelly silt loam. In other areas the soil is 40 to 60 inches deep over bedrock or has less than 6 percent organic carbon in the upper part of the subsoil.

Included in this unit are small areas of Klapatche, Nagrom, Playco, and Stahl soils and Hartnit soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Hartnit soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are western redcedar and Douglas fir. The common forest understory plants are red huckleberry, blueleaved huckleberry, bunchberry dogwood, deer fern, western brackenfern, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 101. On the basis of a 50-year site curve, it is estimated to be 75. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully

laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

72—Haywire sandy loam, 8 to 30 percent slopes.

This well drained soil is on ridgetops and mountain back slopes. It is moderately deep to bedrock. It formed in volcanic ash and pumice over colluvium and residuum derived dominantly from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 6,000 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles and twigs 1 inch thick. When mixed to a depth of 4 inches, the surface layer is dusky red sandy loam. In sequence downward, the subsoil is 5 inches of dark reddish brown loam, 8 inches of dark reddish brown gravelly loam, 8 inches of dark brown very cobbly loam, and 11 inches of dark yellowish brown extremely cobbly loam. Andesite is at a depth of about 36 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, loam, or gravelly loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Nagrom, Nimue, and Playco soils and Haywire soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Haywire soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, deer fern, prince's pine, salal, dwarf huckleberry, pachystima, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 87. On the basis of a 50-year site curve, it is 59. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 100 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical

or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

73—Haywire sandy loam, 30 to 65 percent slopes.

This well drained soil is on ridgetops and mountain back slopes. It is moderately deep to bedrock. It formed in volcanic ash and pumice over colluvium and residuum derived dominantly from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 6,000 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles and twigs 1 inch thick. When mixed to a depth of 4 inches, the surface layer is dusky red sandy loam. In sequence downward, the subsoil is 5 inches of dark reddish brown loam, 8 inches of dark reddish brown gravelly loam, 8 inches of dark brown very cobbly loam, and 11 inches of dark yellowish brown extremely cobbly loam. Andesite is at a depth of about 36 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, loam, or gravelly loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Nagrom, Nimue, and Playco soils and Haywire soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Haywire soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, deer fern, prince's pine, salal, dwarf huckleberry, pachystima, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 87. On the basis of a 50-year site curve, it is 59. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 100 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are

snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

74—Haywire loamy sand, tuff substratum, 8 to 30 percent slopes. This well drained soil is on ridgetops and mountain back slopes. It is moderately deep to bedrock. It formed in volcanic ash and pumice over colluvium and residuum derived dominantly from tuff or breccia. The native vegetation is mainly conifers and

shrubs. Elevation is 3,400 to 6,000 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of decomposed needles and twigs 3 inches thick. When mixed to a depth of 8 inches, the surface layer is dusky red loamy sand. The upper 6 inches of the subsoil is dark brown very cobbly loam. The lower 16 inches is dark yellowish brown extremely gravelly loam. Breccia is at a depth of about 30 inches. The depth to tuff or breccia ranges from 20 to 40 inches. In some areas the surface layer is sandy loam, loam, or gravelly sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to tuff, breccia, or andesite.

Included in this unit are small areas of Nagrom, Nimue, and Playco soils and Haywire soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Haywire soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, deer fern, princes pine, salal, dwarf huckleberry, pachystima, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 87. On the basis of a 50-year site curve, it is 59. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 100 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to

maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

75—Haywire loamy sand, tuff substratum, 30 to 65 percent slopes. This well drained soil is on ridgetops and mountain back slopes. It is moderately deep to bedrock. It formed in volcanic ash and pumice over colluvium and residuum derived dominantly from tuff or breccia. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 6,000 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of decomposed needles and twigs 3 inches thick. When mixed to a depth of 8 inches, the surface layer is dusky red loamy sand. The upper 6 inches of the subsoil is dark brown very cobbly loam. The lower 16 inches is dark yellowish brown extremely gravelly loam. Breccia

is at a depth of about 30 inches. The depth to tuff or breccia ranges from 20 to 40 inches. In some areas the surface layer is sandy loam, loam, or gravelly sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to tuff, breccia, or andesite.

Included in this unit are small areas of Nagrom, Nimue, and Playco soils and Haywire soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Haywire soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, deer fern, prince's pine, salal, dwarf huckleberry, pachystima, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 87. On the basis of a 50-year site curve, it is 59. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 100 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and

firebreaks are subject to rilling and gully erosion unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

76—Hinker gravelly sandy loam, 8 to 30 percent slopes. This well drained soil is on glacially modified mountain shoulder slopes. It is moderately deep to bedrock. It formed in volcanic ash and in colluvium derived dominantly from phyllite. The native vegetation is mainly conifers and shrubs. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 95 inches, and the average annual air temperature is about 41 degrees F. The average frost-free period is about 90 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 9 inches of the subsoil is dark brown and strong brown very channery loam. The lower 5 inches is dark grayish brown very channery loam. The substratum is dark grayish brown extremely channery loam 16 inches thick. Phyllite is at a depth of about 38 inches. The depth to phyllite ranges from 20 to 40 inches. In some areas the surface layer is very channery sandy loam, gravelly loam, or gravelly loamy sand. In other areas the soil has less than 6 percent organic carbon in the lower part of the subsoil,

is 40 to 60 inches deep to phyllite, or has a less developed subsoil.

Included in this unit are small areas of Crinker, Reggad, and Treen soils, soils that are 20 to 40 inches deep to dense glacial till, soils that are 14 to 20 inches deep to phyllite, Rock outcrop, and Hinker soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Hinker soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are Alaska cedar and mountain hemlock. The common forest understory plants are tall blue huckleberry, bunchberry dogwood, deer fern, western brackenfern, and salmonberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 91. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 107 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality phyllite. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

77—Hinker gravelly sandy loam, 30 to 65 percent slopes. This well drained soil is on glacially modified mountain shoulder slopes. It is moderately deep to bedrock. It formed in volcanic ash and in colluvium derived dominantly from phyllite. The native vegetation is mainly conifers and shrubs. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 95 inches, and the average annual air temperature is about 41 degrees F. The average frost-free period is about 90 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 9 inches of the subsoil is dark brown and strong brown very channery loam. The lower 5 inches is dark grayish brown very channery loam. The substratum is dark grayish brown extremely channery loam 16 inches thick. Phyllite is at a depth of about 38 inches. The depth to phyllite ranges from 20 to 40 inches. In some areas the surface layer is very channery sandy loam, gravelly loam, or gravelly loamy sand. In other areas the soil has less than 6 percent organic carbon in the lower part of the subsoil, is 40 to 60 inches deep to phyllite, or has a less developed subsoil.

Included in this unit are small areas of soils that are 20 to 40 inches deep to dense glacial till, soils that are 14 to 20 inches deep to phyllite, Rock outcrop, and Hinker soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Hinker soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are Alaska cedar and

mountain hemlock. The common forest understory plants are tall blue huckleberry, bunchberry dogwood, deer fern, western brackenfern, and salmonberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 91. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 107 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality phyllite. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

78—Hinker gravelly sandy loam, 65 to 90 percent slopes. This well drained soil is on glacially modified mountain shoulder slopes. It is moderately deep to bedrock. It formed in volcanic ash and in colluvium derived dominantly from phyllite. The native vegetation is mainly conifers and shrubs. Elevation is 3,500 to 4,200 feet. The average annual precipitation is about 95 inches, and the average annual air temperature is about 41 degrees F. The average frost-free period is about 85 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 9 inches of the subsoil is dark brown and strong brown very channery loam. The lower 5 inches is dark grayish brown very channery loam. The substratum is dark grayish brown extremely channery loam 16 inches thick. Phyllite is at a depth of about 38 inches. The depth to phyllite ranges from 20 to 40 inches. In some areas the surface layer is very channery sandy loam, gravelly loam, or gravelly loamy sand. In other areas the soil has less than 6 percent organic carbon in the lower part of the subsoil, is 40 to 60 inches deep to phyllite, or has a less developed subsoil.

Included in this unit are small areas of soils that are 20 to 40 inches deep to dense glacial till, soils that are 14 to 20 inches deep to phyllite, Rock outcrop, and Hinker soils that have slopes of more than 90 percent or less than 65 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Hinker soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are Alaska cedar and mountain hemlock. The common forest understory plants are tall blue huckleberry, bunchberry dogwood, deer fern, western brackenfern, and salmonberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 91. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 107 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May.

When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality phyllite. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or Pacific silver fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

79—Humaquepts, 0 to 5 percent slopes. These very deep, poorly drained soils are on terraces. They formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 140 days.

No single profile is representative of these soils. One of the more commonly observed ones, however, is covered with a mat of needles, leaves, and twigs 1 inch thick. Typically, the surface layer is very dark grayish

brown silt loam 13 inches thick. The subsoil is grayish brown, mottled gravelly silty clay loam 12 inches thick. The substratum to a depth of 60 inches is grayish brown very gravelly loam. The distribution of organic carbon varies with increasing depth. The surface layer is organic or mineral. In some areas the subsoil and substratum are very cobbly loam.

Included in this unit are small areas of organic soils and alluvial soils. The alluvial soils are better drained than the Humaquepts. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow in the Humaquepts. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at a depth of 0.5 to 1.0 foot from December through April. The soils are subject to rare periods of flooding. Runoff is very slow, and there is no hazard of erosion.

This unit is used for woodland or wildlife habitat. Red alder is the main woodland species. Among the trees of limited extent are western redcedar, Sitka spruce, black cottonwood, and western hemlock. The common forest understory plants are willows, sedges, rushes, salmonberry, and thimbleberry.

On the basis of a 50-year site curve, the mean site index for red alder is estimated to be 85. The highest average growth rate in unmanaged, even-aged stands of red alder is about 92 cubic feet per acre per year, occurring at age 40.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soils are wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soils. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soils are moist and a high degree of puddling when the soils are wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. When the surface layer is removed by harvesting activities, seedlings planted in the less fertile underlying material grow poorly and lack vigor. Reforestation can be accomplished by planting western redcedar, Sitka spruce, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder and western redcedar occurs

occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soils are wet and winds are strong.

This unit is in capability subclass VIw.

80—Index loamy sand, 8 to 30 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice mixed with colluvium derived dominantly from granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown loamy sand. The upper 8 inches of the subsoil is dark brown very cobbly loamy sand. The lower 8 inches is dark yellowish brown very gravelly loamy sand. The upper 17 inches of the substratum is light yellowish brown extremely cobbly sand. The lower 17 inches is pale yellow extremely cobbly sand. Highly weathered granodiorite is at a depth of about 57 inches. The depth to granitic or metamorphic rocks ranges from 40 to 70 inches. In some areas the surface layer is sandy loam, gravelly loamy sand, or very gravelly loamy sand. In other areas the soil has a substratum of very gravelly sandy loam, has 15 to 35 percent rock fragments in the subsoil, or is underlain by conglomerate.

Included in this unit are small areas of Klapatche soils, soils that are 10 to 20 deep inches to bedrock, Rock outcrop, and Index soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid in the Index soil. Available water capacity is low. The effective rooting depth is 40 to 70 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Douglas fir, and Alaska cedar. The common forest understory plants are salal, huckleberry, common beargrass, longtube twinflower, bunchberry dogwood, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 111. On

the basis of a 50-year site curve, it is estimated to be 81. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 162 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VI.

81—Index loamy sand, 30 to 65 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice mixed with colluvium derived dominantly from granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of

needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown loamy sand. The upper 8 inches of the subsoil is dark brown very cobbly loamy sand. The lower 8 inches is dark yellowish brown very gravelly loamy sand. The upper 17 inches of the substratum is light yellowish brown extremely cobbly sand. The lower 17 inches is pale yellow extremely cobbly sand. Highly weathered granodiorite is at a depth of about 57 inches. The depth to granitic or metamorphic rocks ranges from 40 to 70 inches. In some areas the surface layer is sandy loam, gravelly loamy sand, or very gravelly loamy sand. In other areas the soil has a substratum of very gravelly sandy loam, has 15 to 35 percent rock fragments in the subsoil, or is underlain by conglomerate.

Included in this unit are small areas of Klapatche soils, soils that are 10 to 20 inches deep to bedrock, Rock outcrop, and Index soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid in the Index soil. Available water capacity is low. The effective rooting depth is 40 to 70 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Douglas fir, and Alaska cedar. The common forest understory plants are salal, huckleberry, common beargrass, longtube twinflower, bunchberry dogwood, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 111. On the basis of a 50-year site curve, it is estimated to be 81. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 162 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for

road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VII.

82—Index loamy sand, 65 to 90 percent slopes.

This deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice mixed with colluvium derived dominantly from granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown loamy sand. The upper 8 inches of the subsoil is dark brown very cobbly loamy sand. The lower 8 inches is dark yellowish brown very gravelly loamy sand. The upper 17 inches of the substratum is light yellowish brown extremely cobbly sand. The lower 17 inches is pale yellow extremely cobbly sand. Highly weathered granodiorite is at a depth of about 57 inches. The depth to granitic or metamorphic rocks ranges from 40 to 70 inches. In some areas the surface layer is sandy loam, gravelly loamy sand, or very gravelly loamy sand. In other areas the soil has a substratum of very gravelly sandy loam, has 15 to 35 percent rock fragments in the subsoil, or is underlain by conglomerate.

Included in this unit are small areas of Klapatche soils, soils that are 10 to 20 inches deep to bedrock, Rock outcrop, and Index soils that have slopes of less than 65 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid in the Index soil. Available water capacity is low. The effective rooting depth is 40 to 70 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Douglas fir, and Alaska cedar. The common forest understory plants are salal, huckleberry, common beargrass, longtube twinflower, bunchberry dogwood, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 111. On the basis of a 50-year site curve, it is estimated to be 81. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 162 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting

timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock or Pacific silver fir occurs periodically.

This unit is in capability subclass VIIIs.

83—Index-Rock outcrop complex, 45 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

This unit is 45 percent Index loamy sand and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Klapatche and Reggad soils, talus, soils that are 10 to 20 inches deep over bedrock, and Index soils that have slopes of less than 45 percent. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Index soil is deep and well drained. It formed in volcanic ash and pumice mixed with colluvium derived dominantly from granitic and metamorphic rocks. Typically, the surface is covered with a mat of needles, twigs, bark, and moss 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown loamy sand. The upper 8 inches of the subsoil is dark brown very cobbly loamy sand. The lower 8 inches is dark yellowish brown very gravelly loamy sand. The upper 17 inches of the substratum is light yellowish brown extremely cobbly sand. The lower 17 inches is pale yellow extremely cobbly sand. Highly weathered granodiorite is at a depth of about 57 inches. The depth to granitic or metamorphic rocks ranges from 40 to 70 inches. In some areas the surface layer is sandy loam, gravelly loamy sand, or very gravelly loamy sand. In other areas the soil has a substratum of very gravelly sandy loam, has 15 to 35 percent rock fragments in the subsoil, or is underlain by conglomerate.

Permeability is rapid in the Index soil. Available water capacity is low. The effective rooting depth is 40 to 70 inches. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is granitic or

metamorphic rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Douglas fir, and Alaska cedar. The common forest understory plants are salal, huckleberry, common beargrass, longtube twinflower, bunchberry dogwood, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 111. On the basis of a 50-year site curve, it is estimated to be 81. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 162 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 30 percent of this unit.

The main limitations affecting timber harvesting are snowpack, the Rock outcrop, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting

timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation.

The Index soil is in capability subclass VII_s. The Rock outcrop is in capability subclass VIII_s.

84—Jonas gravelly loam, tuff substratum, 15 to 30 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in colluvium and residuum derived from tuff and breccia. The colluvium and residuum have an admixture of volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly loam 6 inches thick. The subsoil also is dark brown gravelly loam. It is 37 inches thick. The substratum is dark brown very gravelly loam 11 inches thick. Weathered tuff is at a depth of about 54 inches. The depth to weathered tuff or breccia ranges from 40 to 60 inches. In some areas the surface layer is gravelly silt loam or very gravelly loam. In other areas the soil has 35 to 50 percent rock fragments in the subsoil, is underlain by andesite, or is more than 60 inches deep over bedrock.

Included in this unit are small areas of Littlejohn, Pheeney, Pitcher, and Zynbar soils and Jonas soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Jonas soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are red huckleberry, violet, wild ginger, salal, western swordfern, western brackenfern, blackberry, vine maple, Oregon oxalis, Oregongrape, blueleaved huckleberry, Pacific trillium, and bedstraw.

On the basis of a 100-year site curve, the mean site index is 158 for Douglas fir and 160 for western hemlock. On the basis of a 50-year site curve, it is 121 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 168 cubic feet per acre per year, occurring at age 65. For western hemlock it is 254 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

85—Jonas gravelly loam, tuff substratum, 30 to 65 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in colluvium and residuum derived from tuff and breccia. The colluvium and residuum have an admixture of volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of

needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly loam 6 inches thick. The subsoil also is dark brown gravelly loam. It is 37 inches thick. The substratum is dark brown very gravelly loam 11 inches thick. Weathered tuff is at a depth of about 54 inches. The depth to weathered tuff or breccia ranges from 40 to 60 inches. In some areas the surface layer is gravelly silt loam or very gravelly loam. In other areas the soil has 35 to 50 percent rock fragments in the subsoil, is underlain by andesite, or is more than 60 inches deep over bedrock.

Included in this unit are small areas of Littlejohn, Pheeney, Pitcher, and Zynbar soils and Jonas soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Jonas soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are red huckleberry, violet, wild ginger, salal, western swordfern, western brackenfern, blackberry, vine maple, Oregon oxalis, Oregongrape, blueleaved huckleberry, Pacific trillium, and bedstraw.

On the basis of a 100-year site curve, the mean site index is 158 for Douglas fir and 160 for western hemlock. On the basis of a 50-year site curve, it is 121 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 168 cubic feet per acre per year, occurring at age 65. For western hemlock it is 254 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are occasional snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully

laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

86—Jonas gravelly silt loam, 15 to 30 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in colluvium and residuum derived from andesite. The colluvium and residuum have an admixture of volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly silt loam 16 inches thick. The subsoil is dark brown gravelly clay loam 26 inches thick. The substratum to a depth of 60 inches is dark yellowish brown gravelly clay loam. In some areas the surface layer is gravelly or very gravelly loam. In other areas the soil has 35 to 50 percent rock fragments in the subsoil or is underlain by andesite or breccia at a depth of 40 to 60 inches.

Included in this unit are small areas of Littlejohn, Pheeney, Pitcher, and Zynbar soils and Jonas soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Jonas soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species.

Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are red huckleberry, violet, wild ginger, salal, western swordfern, western brackenfern, blackberry, vine maple, Oregon oxalis, Oregon grape, blueleaved huckleberry, Pacific trillium, and bedstraw.

On the basis of a 100-year site curve, the mean site index is 158 for Douglas fir and 110 for western hemlock. On the basis of a 50-year site curve, it is 121 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 168 cubic feet per acre per year, occurring at age 65. For western hemlock it is 254 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

87—Jonas gravelly silt loam, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in colluvium and residuum derived from andesite. The colluvium and residuum have an admixture of volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is

about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly silt loam 16 inches thick. The subsoil is dark brown gravelly clay loam 26 inches thick. The substratum to a depth of 60 inches is dark yellowish brown gravelly clay loam. In some areas the surface layer is gravelly or very gravelly loam. In other areas the soil has 35 to 50 percent rock fragments in the subsoil or is underlain by andesite or breccia at a depth of 40 to 60 inches.

Included in this unit are small areas of Littlejohn, Pheeney, Pitcher, and Zynbar soils and Jonas soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Jonas soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are red huckleberry, violet, wild ginger, salal, western swordfern, western brackenfern, blackberry, vine maple, Oregon oxalis, Oregongrape, blueleaved huckleberry, Pacific trillium, and bedstraw.

On the basis of a 100-year site curve, the mean site index is 158 for Douglas fir and 160 for western hemlock. On the basis of a 50-year site curve, it is 121 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 168 cubic feet per acre per year, occurring at age 65. For western hemlock it is 254 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are occasional snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully

laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

88—Jonas gravelly silt loam, 65 to 90 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in colluvium and residuum derived from andesite. The colluvium and residuum have an admixture of volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly silt loam 16 inches thick. The subsoil is dark brown gravelly clay loam 26 inches thick. The substratum to a depth of 60 inches is dark yellowish brown gravelly clay loam. In some areas the surface layer is gravelly or very gravelly loam. In other areas the soil has 35 to 50 percent rock fragments in the subsoil or is underlain by andesite or breccia at a depth of 40 to 60 inches.

Included in this unit are small areas of Littlejohn, Pheeney, Pitcher, and Zynbar soils, Rock outcrop, and Jonas soils that have slopes of less than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Jonas soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf

maple, and western redcedar. The common forest understory plants are red huckleberry, violet, wild ginger, salal, western swordfern, western brackenfern, blackberry, vine maple, Oregon oxalis, Oregongrape, blueleaved huckleberry, Pacific trillium, and bedstraw.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 158 and for western hemlock is 160. On the basis of a 50-year site curve, the mean site index for Douglas fir is 121 and for western hemlock is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 168 cubic feet per acre per year, occurring at age 65. For western hemlock it is 254 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are occasional snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Extra rock is needed to maintain a stable and uniform road surface. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

89—Kaleetan sandy loam, 8 to 30 percent slopes.

This very deep, well drained soil is on glacially modified mountain back slopes and toe slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from andesite and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. When mixed to a depth of 4 inches, the surface layer is dark reddish brown sandy loam. The upper 5 inches of the subsoil is variegated dark brown and yellowish red gravelly sandy loam. The lower 26 inches is brown and yellowish brown very gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown extremely gravelly sandy loam. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil has a substratum of loamy sand, is 40 to 60 inches deep to dense glacial till or bedrock, is moderately well drained, or has less than 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Philipppa, Marblemount, Littlejohn, and Pitcher soils, slump areas, poorly drained soils in depressions, and Kaleetan soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kaleetan soil. Available water capacity also is moderate. The effective rooting depth is 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are Oregongrape, salal, western swordfern, red huckleberry, Pacific trillium, vine maple, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145. On the basis of a 50-year site curve, it is 113. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 152 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet

causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Plant competition is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIe.

90—Kaleetan sandy loam, 30 to 65 percent slopes.

This very deep, well drained soil is on glacially modified mountain back slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from andesite and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. When mixed to a depth of 4 inches, the surface layer is dark reddish brown sandy loam. The upper 5 inches of the subsoil is variegated dark brown gravelly sandy loam. The lower 26 inches is brown and yellowish brown very gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown very gravelly sandy loam and extremely gravelly sandy loam. In some areas the soil has a substratum of loamy sand, is 40 to 60 inches deep to dense glacial till or bedrock, is moderately well drained, or has less than 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Littlejohn, Marblemount, Philippa, and Pitcher soils, slump areas,

and Kaleetan soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kaleetan soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are Oregon grape, salal, western swordfern, red huckleberry, Pacific trillium, vine maple, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145. On the basis of a 50-year site curve, it is 113. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 152 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs

periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

91—Kaleetan sandy loam, windswept, 30 to 65 percent slopes. This very deep, well drained soil is on glacially modified mountain back slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from andesite and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. When mixed to a depth of 4 inches, the surface layer is dark reddish brown sandy loam. The upper 5 inches of the subsoil is variegated dark brown gravelly sandy loam. The lower 26 inches is brown and yellowish brown very gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown very gravelly sandy loam and extremely gravelly sandy loam. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil has a substratum of loamy sand, is 40 to 60 inches deep to dense glacial till or bedrock, is moderately well drained, or has less than 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Littlejohn, Marblemount, Philippa, and Pitcher soils, slump areas, and Kaleetan soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kaleetan soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are Oregongrape, salal, western swordfern, red huckleberry, Pacific trillium, vine maple, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 117. On the basis of a 50-year site curve, it is 90. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. The trees are desiccated

in winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

92—Kaleetan sandy loam, till substratum, 8 to 30 percent slopes. This deep, well drained soil is on glacially modified mountain back slopes and toe slopes. It formed in a mixture of volcanic ash and colluvium over andesite and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 6 inches thick. When mixed

to a depth of 5 inches, the surface layer is dark reddish brown sandy loam. The upper 7 inches of the subsoil is dark yellowish brown gravelly sandy loam. The lower 11 inches is dark yellowish brown very gravelly loam. The substratum is olive brown very gravelly loamy sand 18 inches thick. Dense glacial till is at a depth of about 41 inches. The depth to dense glacial till ranges from 40 to 60 inches. The dense glacial till is similar to a cemented pan. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil is more than 60 inches deep to dense glacial till or has less than 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Littlejohn, Marblemount, Philippa, and Pitcher soils, soils that are similar to this Kaleetan soil but have dense glacial till at a depth of 20 to 40 inches, slump areas, poorly drained soils in depressions, and Kaleetan soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kaleetan soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Water is perched above the dense glacial till from November through March. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are Oregongrape, salal, western swordfern, red huckleberry, Pacific trillium, vine maple, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index is 140 for Douglas fir and 125 for western hemlock. On the basis of a 50-year site curve, it is 109 for Douglas fir and 105 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 145 cubic feet per acre per year, occurring at age 65. For western hemlock it is 190 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a

moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIe.

93—Kaleetan sandy loam, till substratum, 30 to 65 percent slopes. This deep, well drained soil is on glacially modified mountain back slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from andesite and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 6 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown sandy loam. The upper 7 inches of the subsoil is dark yellowish brown gravelly sandy loam. The lower 11 inches is dark yellowish brown very gravelly loam. The substratum is olive brown very gravelly loamy sand 18 inches thick. Dense glacial till is at a depth of about 41 inches. The depth to dense glacial till ranges from 40 to 60 inches. The dense glacial till is similar to a cemented pan. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil is more than 60 inches deep to dense glacial till or has less than 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Littlejohn, Marblemount, Philippa, and Pitcher soils, soils that are similar to this Kaleetan soil but have dense glacial till at a depth of 20 to 40 inches, slump areas, and Kaleetan soils that have slopes of more than 65 percent or less

than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kaleetan soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Water is perched above the dense glacial till from November through March. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are Oregon grape, salal, western swordfern, red huckleberry, Pacific trillium, vine maple, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index is 140 for Douglas fir and 125 for western hemlock. On the basis of a 50-year site curve, it is 109 for Douglas fir and 105 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 145 cubic feet per acre per year, occurring at age 65. For western hemlock it is 190 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural

reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

94—Kaleetan sandy loam, tuff substratum, 8 to 30 percent slopes. This very deep, well drained soil is on glacially modified mountain back slopes and toe slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from tuff, breccia, and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 6 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown sandy loam. The upper 11 inches of the subsoil is dark yellowish brown gravelly sandy loam. The lower 17 inches is dark brown very gravelly loam. The substratum to a depth of 60 inches is brown extremely gravelly sandy loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil has a substratum of very gravelly loamy sand, is 40 to 60 inches deep to dense glacial till or bedrock, is moderately well drained, or has less than 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Littlejohn, Marblemount, Philippa, and Pitcher soils, slump areas, poorly drained soils in depressions, and Kaleetan soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kaleetan soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are Oregon grape, salal, western swordfern, red huckleberry, Pacific trillium, vine maple, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145. On the basis of a 50-year site curve, it is 113. The highest average growth rate in

unmanaged, even-aged stands of Douglas fir is 152 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIe.

95—Kaleetan sandy loam, tuff substratum, 30 to 65 percent slopes. This very deep, well drained soil is on glacially modified mountain back slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from tuff, breccia, and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of

needles, leaves, and twigs 6 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown sandy loam. The upper 11 inches of the subsoil is dark yellowish brown gravelly sandy loam. The lower 17 inches is dark brown very gravelly loam. The substratum to a depth of 60 inches is brown extremely gravelly sandy loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil has a substratum of loamy sand, is 40 to 60 inches deep to dense glacial till or bedrock, is moderately well drained, or has less than 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Littlejohn, Marblemount, Philippa, and Pitcher soils, slump areas, and Kaleetan soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kaleetan soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are Oregon grape, salal, western swordfern, red huckleberry, Pacific trillium, vine maple, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145. On the basis of a 50-year site curve, it is 113. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 152 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil

is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

96—Kanaskat gravelly sandy loam, 0 to 30 percent slopes. This very deep, well drained soil is on back slopes in the foothills. It formed in a mixture of volcanic ash, colluvium, and material weathered from extrusive rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,700 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 155 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is grayish brown gravelly sandy loam 11 inches thick. The upper 12 inches of the subsoil is dark yellowish brown extremely gravelly loam. The lower 15 inches is yellowish brown very gravelly sandy loam. The substratum to a depth of 60 inches is light olive brown extremely gravelly coarse sandy loam. In some areas the surface layer is very gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Ogarty soils and Kanaskat soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kanaskat soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, red alder, bigleaf maple, and western redcedar. The common forest understory plants are salal, Oregongrape, western swordfern, longtube twinflower, western brackenfern, vine maple, red huckleberry, trailing blackberry, and bitter cherry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 144. On the basis of a 50-year site curve, it is 113. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

97—Kanaskat gravelly sandy loam, 30 to 65 percent slopes. This very deep, well drained soil is on back slopes in the foothills. It formed in a mixture of volcanic ash, colluvium, and material weathered from extrusive rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,700 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 155 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is grayish brown gravelly sandy loam 11 inches thick. The upper 12 inches of the subsoil is dark yellowish brown extremely gravelly loam. The lower 15 inches is yellowish brown very gravelly sandy loam. The substratum to a depth of 60 inches is light olive brown extremely gravelly coarse sandy loam. In some areas the surface layer is very gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Ogarty soils and Kanaskat soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kanaskat soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, red alder, bigleaf maple, and western redcedar. The common forest understory plants are salal, Oregon grape, western swordfern, longtube twinflower, western brackenfern, vine maple, red huckleberry, trailing blackberry, and bitter cherry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 144. On the basis of a 50-year site curve, it is 113. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIle.

98—Kanaskat gravelly sandy loam, tuff substratum, 8 to 30 percent slopes. This very deep, well drained soil is on back slopes in the foothills. It formed in a mixture of volcanic ash, colluvium, and material weathered from tuff and breccia. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,700 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 155 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark brown gravelly sandy loam 7 inches thick. The upper 11 inches of the subsoil is dark reddish brown and yellowish brown very gravelly sandy loam. The lower 12 inches is dark brown very gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown very gravelly sandy loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is very gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Ogarty soils and Kanaskat soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kanaskat soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, red alder, bigleaf maple, and western redcedar. The common forest understory plants are salal, Oregon grape, western swordfern, longtube twinflower, western brackenfern, vine maple, red huckleberry, trailing blackberry, and bitter cherry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 144. On the basis of a 50-year site curve, it is 113. The highest average growth rate in

unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

99—Kanaskat gravelly sandy loam, tuff substratum, 30 to 65 percent slopes. This very deep, well drained soil is on back slopes in the foothills. It formed in a mixture of volcanic ash, colluvium, and material weathered from tuff and breccia. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,700 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 155 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark brown gravelly sandy loam 7 inches thick. The upper 11 inches of the subsoil is dark reddish brown and yellowish brown very gravelly sandy loam.

The lower 12 inches is dark brown very gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown very gravelly sandy loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is very gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Ogarty soils and Kanaskat soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Kanaskat soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, red alder, bigleaf maple, and western redcedar. The common forest understory plants are salal, Oregongrape, western swordfern, longtube twinflower, western brackenfern, vine maple, red huckleberry, trailing blackberry, and bitter cherry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 144. On the basis of a 50-year site curve, it is 113. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

100—Kapowsin gravelly loam, 6 to 15 percent slopes. This moderately well drained soil is on glacial till plains. It is moderately deep to ortstein. It formed in dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 50 to 800 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is very dark grayish brown gravelly loam 9 inches thick. The upper 15 inches of the subsoil is dark brown gravelly loam. The lower 13 inches is dark yellowish brown gravelly sandy loam. Brown ortstein that crushes to gravelly sandy loam is at a depth of about 37 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is gravelly silt loam or very gravelly loam. In other areas the soil is 40 to 60 inches deep to ortstein.

Included in this unit are small areas of Alderwood, Barneston, Lynnwood, and Norma soils and Kapowsin soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Kapowsin soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from December through June. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used as pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used as woodland. If irrigated, it also is suitable as pasture and hayland.

Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western redcedar, western hemlock, and bigleaf maple. The common forest understory plants are Oregongrape, western brackenfern, western swordfern, vine maple, and salal.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 161. On the basis of a 50-year

site curve, it is 123. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 171 cubic feet per acre per year, occurring at age 65.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of planted Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IIIe.

101—Kapowsin gravelly loam, 15 to 30 percent slopes. This moderately well drained soil is on glacial till plains. It is moderately deep to ortstein. It formed in dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 50 to 800 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is very dark grayish brown gravelly loam 9 inches thick. The upper 15 inches of the subsoil is dark brown gravelly loam. The lower 13 inches is dark yellowish brown gravelly sandy loam. Brown ortstein that crushes to gravelly sandy loam is at a depth of about 37 inches. The depth to ortstein ranges from 20 to 40 inches. In

some areas the surface layer is gravelly silt loam or very gravelly loam. In other areas the soil is 40 to 60 inches deep to ortstein.

Included in this unit are small areas of Alderwood, Barneston, and Lynnwood soils and Kapowsin soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Kapowsin soil and very slow in the ortstein. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from December through June. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western redcedar, western hemlock, and bigleaf maple. The common forest understory plants are Oregon grape, western brackenfern, western swordfern, vine maple, and salal.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 161. On the basis of a 50-year site curve, it is 123. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 171 cubic feet per acre per year, occurring at age 65.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of planted Douglas fir seedlings.

Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

102—Kapowsin gravelly loam, 30 to 65 percent slopes. This moderately well drained soil is on glacial till plains. It is moderately deep to ortstein. It formed in dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 50 to 800 feet. The average annual precipitation is about 40 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is very dark grayish brown gravelly loam 9 inches thick. The upper 15 inches of the subsoil is dark brown gravelly loam. The lower 13 inches is dark yellowish brown gravelly sandy loam. Brown ortstein that crushes to gravelly sandy loam is at a depth of about 37 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is gravelly silt loam or very gravelly loam. In other areas the soil is 40 to 60 inches deep to ortstein.

Included in this unit are small areas of Alderwood, Barneston, and Lynnwood soils and Kapowsin soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Kapowsin soil and very slow in the ortstein. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from December through June. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western redcedar, western hemlock, and bigleaf maple. The common forest understory plants are Oregon grape, western brackenfern, western swordfern, vine maple, and salal.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 161. On the basis of a 50-year site curve, it is 123. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 171 cubic feet per acre per year, occurring at age 65.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to

deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of planted Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

103—Kindy gravelly loam, 0 to 15 percent slopes.

This moderately well drained soil is on glacially modified mountain back slopes and plateaus. It is moderately deep to ortstein. It formed in a mixture of volcanic ash and colluvium over dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,700 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 105 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown gravelly loam. The upper 4 inches of the subsoil is dark reddish brown and yellowish red gravelly silt loam. The next 13 inches is dark brown and dark yellowish brown very gravelly loam. The lower 9 inches is brown and strong brown very gravelly sandy loam. Dark grayish brown ortstein that crushes to very gravelly sandy loam is at a depth of about 32 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is gravelly sandy loam, gravelly silt loam, or very gravelly loam. In other areas the soil has less than 35

percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock or dense glacial till.

Included in this unit are small areas of Index, Klapatche, and Playco soils, Rock outcrop, and Kindy soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Kindy soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are Pacific silver fir and western redcedar. The common forest understory plants are tall blue huckleberry, salmonberry, deer fern, western brackenfern, red huckleberry, and salal.

On the basis of a 100-year site curve, the mean site index is 135 for western hemlock and is estimated to be 120 for Douglas fir. On the basis of a 50-year site curve, it is 96 for western hemlock and is estimated to be 95 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 209 cubic feet per acre per year, occurring at age 50. For Douglas fir it is about 115 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from December through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. The

seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

104—Kindy gravelly loam, 15 to 30 percent slopes.

This moderately well drained soil is on glacially modified mountain back slopes and plateaus. It is moderately deep to ortstein. It formed in a mixture of volcanic ash and colluvium over dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,700 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 105 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown gravelly loam. The upper 4 inches of the subsoil is dark reddish brown and yellowish red gravelly silt loam. The next 13 inches is dark brown and dark yellowish brown very gravelly loam. The lower 9 inches is brown and strong brown very gravelly sandy loam. Dark grayish brown ortstein that crushes to very gravelly sandy loam is at a depth of about 32 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is gravelly sandy loam, gravelly silt loam, or very gravelly loam. In other areas the soil has less than 35 percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock or dense glacial till.

Included in this unit are small areas of Index, Klapatche, and Playco soils, Rock outcrop, and Kindy soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Kindy soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are Pacific silver fir and western redcedar. The common forest understory plants are tall blue huckleberry, salmonberry, deer fern, western brackenfern, red huckleberry, and salal.

On the basis of a 100-year site curve, the mean site index is 135 for western hemlock and is estimated to be 120 for Douglas fir. On the basis of a 50-year site curve, it is 96 for western hemlock and is estimated to be 95 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 209 cubic feet per acre per year, occurring at age 50. For Douglas fir it is about 115 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from December through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally

subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

105—Kindy gravelly loam, 30 to 65 percent slopes.

This moderately well drained soil is on glacially modified mountain back slopes and plateaus. It is moderately deep to ortstein. It formed in a mixture of volcanic ash and colluvium over dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,700 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 105 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown gravelly loam. The upper 4 inches of the subsoil is dark reddish brown and yellowish red gravelly silt loam. The next 13 inches is dark brown and dark yellowish brown very gravelly loam. The lower 9 inches is brown and strong brown very gravelly sandy loam. Dark grayish brown ortstein that crushes to very gravelly sandy loam is at a depth of about 32 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is gravelly sandy loam, gravelly silt loam, or very gravelly loam. In other areas the soil has less than 35 percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock or dense glacial till.

Included in this unit are small areas of Index, Klapatche, and Playco soils, Rock outcrop, and Kindy soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Kindy soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through April. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are Pacific silver fir and western redcedar. The common forest understory plants are tall blue huckleberry, salmonberry, deer fern, western brackenfern, red huckleberry, and salal.

On the basis of a 100-year site curve, the mean site index is 135 for western hemlock and is estimated to be 120 for Douglas fir. On the basis of a 50-year site curve, it is 96 for western hemlock and is estimated to be 95 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 209 cubic feet per acre per year, occurring at age 50.

For Douglas fir it is about 115 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from December through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

106—Klapper silt loam, 0 to 8 percent slopes. This very deep, poorly drained soil is on terraces. It formed in lacustrine sediments. The native vegetation is mainly trees and shrubs. Elevation is 100 to 600 feet. The average annual precipitation is about 55 inches, and the

average annual air temperature is about 50 degrees F. The average frost-free period is about 175 days.

When mixed to a depth of 6 inches, the surface layer is very dark grayish brown silt loam. The upper 5 inches of the subsurface layer also is very dark grayish brown silt loam. The lower 11 inches is light brownish gray, mottled silt loam. The upper 14 inches of the subsoil is grayish brown, mottled silty clay. The lower part to a depth of 60 inches is gray silty clay. In some areas the surface layer is silty clay loam or silty clay. In other areas the soil has 20 to 35 percent clay or more than 42 percent clay in the subsoil or substratum.

Included in this unit are small areas of Pastik soils and ponded areas. Included areas make up about 10 percent of the total acreage.

Permeability is slow in the Klaber soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at or above the surface from November through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. It also is suitable as pasture and hayland.

Red alder is the main woodland species. Among the trees of limited extent are Douglas fir, western redcedar, bigleaf maple, and Oregon ash. The common forest understory plants are salal, western brackenfern, western swordfern, spirea, rose, vine maple, and sedges.

On the basis of a 50-year site curve, the mean site index for red alder is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of red alder is about 101 cubic feet per acre per year, occurring at age 40.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table

hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting red alder or western redcedar seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIw.

107—Klabe-Cinebar silt loams, 0 to 8 percent slopes. This map unit is on terraces and toe slopes in the foothills. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,000 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 175 days.

This unit is 60 percent Klabe silt loam, 0 to 3 percent slopes, and 30 percent Cinebar silt loam, 0 to 8 percent slopes. The Klabe soil is in slight depressions. The Cinebar soil is on elongated knolls. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Mashel, Pastik, Scamman, and Wilkeson soils and Cinebar soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

The Klabe soil is very deep and poorly drained. It formed in lacustrine sediments. When mixed to a depth of 6 inches, the surface layer is very dark grayish brown silt loam. The upper 5 inches of the subsurface layer also is very dark grayish brown silt loam. The lower 11 inches is light brownish gray, mottled silt loam. The upper 14 inches of the subsoil is grayish brown, mottled silty clay. The lower part to a depth of 60 inches is gray silty clay. In some areas the surface layer is silty clay loam. In other areas the soil has 20 to 35 percent clay or more than 60 percent clay in the subsoil or substratum.

Permeability is slow in the Klabe soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at or above the surface from November through May. Runoff is slow, and the hazard of water erosion is slight.

The Cinebar soil is very deep and well drained. It formed in loess, volcanic ash, and slope alluvium. Typically, the surface is covered with a mat of needles, leaves, twigs, and moss 2 inches thick. The surface layer is dark brown silt loam 10 inches thick. The

subsoil is dark brown and yellowish brown silt loam 44 inches thick. The substratum to a depth of 60 inches is yellowish brown loam. In some areas the surface layer is loam. In other areas the soil has strata of sandy material in the subsoil.

Permeability is moderate in the Cinebar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. It also is suitable as pasture and hayland.

Douglas fir, red alder, and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and bigleaf maple. The common forest understory plants are salal, western brackenfern, western swordfern, Oregongrape, red huckleberry, spirea, rose, vine maple, trillium, devilsclub, oxalis, and sedges.

On the basis of a 50-year site curve, the mean site index for red alder on the Klaber soil is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of red alder on this soil is about 101 cubic feet per acre per year, occurring at age 40.

On the basis of a 100-year site curve, the mean site index on the Cinebar soil is 174 for Douglas fir and 155 for western hemlock. On the basis of a 50-year site curve, it is 132 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir on this soil is 185 cubic feet per acre per year, occurring at age 60. For western hemlock it is 246 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soils are wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soils. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soils are moist and a high degree of puddling when the soils are wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table in the

Klabe soil hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting red alder or western redcedar on the Klabe soil and Douglas fir on the Cinebar soil. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table in the Klabe soil, trees are frequently subject to windthrow when the soil is wet and winds are strong.

The Klabe soil is in capability subclass VIw. The Cinebar soil is in capability subclass IIe.

108—Klapatche loamy sand, 8 to 30 percent slopes. This well drained soil is on glacially modified mountain ridge crests and back slopes. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and pumice over colluvium derived dominantly from granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 2 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown loamy sand. The upper 4 inches of the subsoil is yellowish red and dark reddish brown very gravelly sandy loam. The lower 8 inches is strong brown very gravelly loamy sand. The upper 11 inches of the substratum is very pale brown extremely cobbly sand. The lower 7 inches is light gray, highly weathered granodiorite. Hard granodiorite is at a depth of about 38 inches. The depth to hard granitic or metamorphic rocks ranges from 30 to 40 inches. In some areas the surface layer is sandy loam, gravelly loamy sand, or very gravelly loamy sand. In other areas the soil has a substratum of very gravelly sandy loam, has 15 to 35 percent rock fragments in the subsoil, or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Nagrom and Playco soils, soils that are 10 to 20 inches deep over bedrock, Rock outcrop, and Klapatche soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Klapatche

soil. Available water capacity is low. The effective rooting depth is 30 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Douglas fir, and Alaska cedar. The common forest understory plants are huckleberry, common beargrass, salal, longtube twinflower, bunchberry dogwood, Oregongrape, princes pine, and Sitka alder.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 101. On the basis of a 50-year site curve, it is estimated to be 72. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds

than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIs.

109—Klapatche loamy sand, 30 to 65 percent slopes. This well drained soil is on glacially modified mountain back slopes. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and pumice over colluvium derived dominantly from granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 2 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown loamy sand. The upper 4 inches of the subsoil is yellowish red and dark reddish brown very gravelly sandy loam. The lower 8 inches is strong brown very gravelly loamy sand. The upper 11 inches of the substratum is very pale brown extremely cobbly sand. The lower 7 inches is light gray, highly weathered granodiorite. Hard granodiorite is at a depth of about 38 inches. The depth to hard granitic or metamorphic rocks ranges from 30 to 40 inches. In some areas the surface layer is sandy loam, gravelly loamy sand, or very gravelly loamy sand. In other areas the soil has a substratum of very gravelly sandy loam, has 15 to 35 percent rock fragments in the subsoil, or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Nagrom and Playco soils, soils that are 10 to 20 inches deep over bedrock, Rock outcrop, and Klapatche soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Klapatche soil. Available water capacity is low. The effective rooting depth is 30 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Douglas fir, and Alaska cedar. The common forest understory plants are

huckleberry, common beargrass, salal, longtube twinflower, bunchberry dogwood, Oregongrape, princes pine, and Sitka alder.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 101. On the basis of a 50-year site curve, it is estimated to be 72. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIIs.

110—Klapatche-Rock outcrop complex, 45 to 90 percent slopes. This map unit is on glacially modified mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

This unit is 45 percent Klapatche loamy sand and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Nagrom, Playco, and Reggad soils, talus, soils that are 10 to 20 inches deep over bedrock, and Klapatche soils that have slopes of less than 45 percent. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Klapatche soil is moderately deep to bedrock and is well drained. It formed in a mixture of volcanic ash and pumice over colluvium derived dominantly from granitic and metamorphic rocks. Typically, the surface is covered with a mat of needles, twigs, bark, and moss 2 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown loamy sand. The upper 4 inches of the subsoil is yellowish red and dark reddish brown very gravelly sandy loam. The lower 8 inches is strong brown very gravelly loamy sand. The upper 11 inches of the substratum is very pale brown extremely cobbly sand. The lower 7 inches is light gray, highly weathered granodiorite. Hard granodiorite is at a depth of about 38 inches. The depth to hard granitic or metamorphic rocks ranges from 30 to 40 inches. In some areas the surface layer is sandy loam, gravelly loamy sand, or very gravelly loamy sand. In other areas the soil has a substratum of very gravelly sandy loam, has 15 to 35 percent rock fragments in the subsoil, or is 40 to 60 inches deep over bedrock.

Permeability is moderately rapid in the Klapatche soil. Available water capacity is low. The effective rooting depth is 30 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is granitic or metamorphic rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, Douglas fir, and Alaska cedar. The common forest understory plants are huckleberry, common beargrass, salal, longtube twinflower, bunchberry dogwood, Oregongrape, princes pine, and Sitka alder.

On the basis of a 100-year site curve, the mean site

index for western hemlock is estimated to be 101. On the basis of a 50-year site curve, it is estimated to be 72. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 30 percent of this unit.

The main limitations affecting timber harvesting are snowpack, the Rock outcrop, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If

seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Klapatche soil is in capability subclass VIIIs. The Rock outcrop is in capability subclass VIIIs.

111—Klaus sandy loam, 0 to 8 percent slopes. This moderately deep, well drained soil is on terraces. It formed in a mixture of volcanic ash and alluvium over glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 700 to 1,400 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 155 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2.5 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown sandy loam. The upper 9 inches of the subsoil is dark brown gravelly sandy loam. The lower 12 inches is brown very gravelly sand. Iron-cemented, brown extremely gravelly sand is at a depth of about 28 inches. The depth to iron-cemented material ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loam. In other areas the soil has less than 35 percent rock fragments in the subsoil, the depth to iron-cemented material is 40 to 60 inches, or the subsoil is very gravelly sandy loam.

Included in this unit are small areas of Cinebar, Nargar, Norma, Ogarty, Persis, and Ragnar soils, poorly drained soils in depressions, and Klaus soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the Klaus soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used as a source of aggregate.

Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent is western redcedar. The common forest understory plants are salal, western swordfern, red huckleberry, vine maple, Oregon grape, deer fern, longtube twinflower, trailing blackberry, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 142. On the basis of a 50-year site curve, it is 111. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 148 cubic feet per acre per year, occurring at age 65.

Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the iron-cemented material in the lower part of the substratum, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

112—Klaus sandy loam, 8 to 15 percent slopes.

This moderately deep, well drained soil is on terraces. It formed in a mixture of volcanic ash and alluvium over glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 700 to 1,400 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 155 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2.5 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown sandy loam. The upper 9 inches of the subsoil is dark brown gravelly sandy loam. The lower 12 inches is brown very gravelly sand. Iron-cemented, brown extremely gravelly sand is at a depth of about 28 inches. The depth to iron-cemented material ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loam. In other areas the soil has less than 35 percent rock

fragments in the subsoil, the depth to iron-cemented material is 40 to 60 inches, or the subsoil is very gravelly sandy loam.

Included in this unit are small areas of Cinebar, Nargar, Norma, Ogarty, Persis, and Ragnar soils, poorly drained soils in depressions, and Klaus soils that have slopes of more than 15 percent or less than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the Klaus soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent is western redcedar. The common forest understory plants are salal, western swordfern, red huckleberry, vine maple, Oregongrape, deer fern, longtube twinflower, trailing blackberry, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 142. On the basis of a 50-year site curve, it is 111. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 148 cubic feet per acre per year, occurring at age 65. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting

depth is restricted by the lower part of the substratum, which is iron cemented, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This map unit is in capability subclass IVe.

113—Klaus sandy loam, 30 to 65 percent slopes.

This moderately deep, well drained soil is on terraces. It formed in a mixture of volcanic ash and alluvium over glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 700 to 1,400 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 155 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2.5 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown sandy loam. The upper 9 inches of the subsoil is dark brown gravelly sandy loam. The lower 12 inches is brown very gravelly sand. Iron-cemented, brown extremely gravelly sand is at a depth of about 28 inches. The depth to iron-cemented material ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loam. In other areas the soil has less than 35 percent rock fragments in the subsoil, the depth to iron-cemented material is 40 to 60 inches, or the subsoil is very gravelly sandy loam.

Included in this unit are small areas of Cinebar, Nargar, Norma, Ogarty, Persis, and Ragnar soils and Klaus soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the Klaus soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent is western redcedar. The common forest understory plants are salal, western swordfern, red huckleberry, vine maple, Oregon grape, deer fern, longtube twinflower, trailing blackberry, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 142. On the basis of a 50-year site curve, it is 111. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 148 cubic feet per acre per year, occurring at age 65. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground

equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, and the using cable systems that lift logs entirely off the ground can reduce the degree of compaction and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of planted Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the lower part of the substratum, which is iron cemented, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

114—Klaus sandy loam, windswept, 0 to 8 percent slopes.

This moderately deep, well drained soil is on terraces. It formed in a mixture of volcanic ash and alluvium over glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 700 to 1,400 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 155 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2.5 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown sandy loam. The upper 9 inches of the subsoil is dark brown gravelly sandy loam. The lower 12 inches is brown very gravelly sand. Iron-cemented, brown extremely gravelly sand is at a depth of about 28 inches. The depth to iron-cemented material ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loam. In other areas the soil has less than 35 percent rock

fragments in the subsoil, the depth to iron-cemented material is 40 to 60 inches, or the subsoil is very gravelly sandy loam.

Included in this unit are small areas of Cinebar, Nargar, Norma, Ogarty, Persis, and Ragnar soils, poorly drained soils in depressions, and Klaus soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the Klaus soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used as a source of aggregate.

Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent is western redcedar. The common forest understory plants are salal, western swordfern, red huckleberry, vine maple, Oregongrape, deer fern, longtube twinflower, trailing blackberry, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 122. On the basis of a 50-year site curve, it is 92. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 118 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and

growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the lower part of the substratum, which is iron cemented, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

115—Klaus sandy loam, windswept, 30 to 65 percent slopes. This moderately deep, well drained soil is on terraces. It formed in a mixture of volcanic ash and alluvium over glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 700 to 1,400 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 155 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2.5 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown sandy loam. The upper 9 inches of the subsoil is dark brown gravelly sandy loam. The lower 12 inches is brown very gravelly sand. Iron-cemented, brown extremely gravelly sand is at a depth of about 28 inches. The depth to iron-cemented material ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loam. In other areas the soil has less than 35 percent rock fragments in the subsoil, the depth to iron-cemented material is 40 to 60 inches, or the subsoil is very gravelly sandy loam.

Included in this unit are small areas of Cinebar, Nargar, Norma, Ogarty, Persis, and Ragnar soils and Klaus soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the Klaus soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent is western redcedar. The common forest understory plants are salal, western swordfern, red huckleberry, vine maple, Oregongrape, deer fern, longtube twinflower, trailing blackberry, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 122. On the basis of a 50-year site curve, it is 92. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 118 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western

hemlock have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of planted Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the lower part of the substratum, which is iron cemented, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

116—Larrupin loamy sand, 3 to 30 percent slopes.

This very deep, well drained soil is on valley bottoms and the adjacent mountain back slopes. It formed in volcanic ash and pumice over volcanic mudflow. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 7 inches thick. The surface layer is dark brown loamy sand 6 inches thick. The upper 18 inches of the subsoil is dark yellowish brown

gravelly loamy sand. The lower 11 inches is dark yellowish brown very gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown very gravelly sandy loam. In some areas the surface layer is gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Lemolo, Littlejohn, and Pitcher soils and Larrupin soils that have slopes of more than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Larrupin soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are salal, Oregongrape, vine maple, red huckleberry, western swordfern, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 118. On the basis of a 50-year site curve, it is 95. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 111 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established

seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs occasionally. Seedlings that are planted or naturally established in the less fertile upper part of the subsoil grow poorly and lack vigor.

This unit is in capability subclass IVe.

117—Larrupin loamy sand, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice over volcanic mudflow. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 7 inches thick. The surface layer is dark brown loamy sand 6 inches thick. The upper 18 inches of the subsoil is dark yellowish brown gravelly sandy loam. The lower 11 inches is dark yellowish brown very gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown very gravelly sandy loam. In some areas the surface layer is gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Lemolo, Littlejohn, and Pitcher soils and Larrupin soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Larrupin soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are salal, Oregongrape, vine maple, red huckleberry, western swordfern, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 118. On the basis of a 50-year site curve, it is 95. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 111 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb

the surface less extensively. They generally are used on this unit. During an average year, snowpack limits the use of equipment and restricts access from January through March. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs occasionally. Seedlings that are planted or naturally established in the less fertile upper part of the subsoil grow poorly and lack vigor.

This unit is in capability subclass VIIe.

118—Larrupin loamy sand, hard substratum, 6 to 30 percent slopes. This deep, well drained soil is on glacially modified mountain back slopes. It formed in volcanic ash and cinders, which are underlain by andesitic block-and-ash flow from Mount Rainier and by dense lahar. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and moss 3 inches thick. The surface layer is dark brown loamy sand 6 inches thick. The upper 11 inches of the subsoil is variegated brown, strong brown, and light gray cindery loamy sand. The lower 18 inches is dark yellowish brown very gravelly loam. The upper 17 inches of the substratum is yellowish brown very cobbly loam. Dark grayish brown, dense lahar that crushes to extremely gravelly sand is at a depth of about 52 inches. The depth to lahar ranges from 40 to 60 inches. The dense lahar is similar to a cemented pan. In some areas the surface layer is cindery loamy sand or cindery sandy loam. In other areas the dense lahar is below a depth of 60 inches.

Included in this unit are small areas of Jonas, Rugles, and Zynbar soils and Larrupin soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Larrupin soil and very slow in the dense lahar. Available water capacity is moderate. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock is the main woodland species. Among the trees of limited extent are Douglas fir, Pacific silver fir, red alder, and western redcedar. The common forest understory plants are salal, Oregongrape, western swordfern, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index for western hemlock is 151. On the basis of a 50-year site curve, it is 105. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 240 cubic feet per acre per year, occurring at age 50. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing

plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

119—Lemolo silt loam, 0 to 8 percent slopes. This very deep, poorly drained soil is on terraces. It formed in Osceola mudflow. The native vegetation is mainly conifers and shrubs. Elevation is 750 to 1,600 feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 180 days.

Typically, the surface is covered with a mat of organic material 6 inches thick. The surface layer is black silt loam 5 inches thick. The subsoil is very dark gray, mottled loam 12 inches thick. The upper 17 inches of the substratum is grayish brown, mottled very gravelly sandy clay loam. The lower part to a depth of 60 inches is gray, mottled very gravelly sandy clay loam. In some areas the surface layer is loam. In other areas the substratum has more than 30 percent clay or has 15 to 50 percent rock fragments.

Included in this unit are small areas of Ohop soils and organic soils. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Lemolo soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is within a depth of 1 foot from November through May. Runoff generally is slow but can be ponded during the winter months. The hazard of water erosion is slight. This soil is subject to rare flooding.

This unit is used as woodland. Western hemlock and red alder are the main woodland species. Among the trees of limited extent are Douglas fir, Sitka spruce, and western redcedar. The common forest understory plants are western swordfern, salal, devilsclub, red huckleberry, vine maple, salmonberry, trailing blackberry, and thimbleberry.

On the basis of a 100-year site curve, the mean site index is 158 for western hemlock. On the basis of a 50-year site curve, it is 113 for western hemlock and 90 for red alder. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 251 cubic feet per acre per year, occurring at age 50. For red alder it is 101 cubic feet per acre per year, occurring at age 40.

The main limitations affecting timber harvesting are occasional snowpack and the muddiness caused by seasonal wetness. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment

can minimize damage to the soil. Unsurfaced roads are soft when wet and may be impassable during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Lowering the water table by installing an effective drainage system increases the productivity of Douglas fir. When the surface layer is removed by harvesting activities, seedlings planted in the less fertile underlying material grow poorly and lack vigor. Reforestation can be accomplished by planting western hemlock or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder and western redcedar occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass Vlw.

120—Littlejohn gravelly sandy loam, 8 to 30 percent slopes. This well drained soil is on mountain back slopes and ridges. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and pumice over residuum and colluvium derived from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark yellowish brown gravelly sandy loam 11 inches thick. The subsoil is dark yellowish brown very gravelly loam 6 inches thick. The substratum is olive brown very gravelly loam 13 inches thick. Fractured andesite is at a depth of about 30 inches. The depth to andesite ranges from 25 to 40 inches. In some areas

the surface layer is cindery loamy sand or gravelly loam. In other areas the soil is 40 to 60 inches deep over bedrock, is moderately well drained, has less than 35 percent rock fragments in the solum or substratum, or is underlain by breccia.

Included in this unit are small areas of Dobbs, Jonas, and Pheeney soils, soils that are 10 to 20 inches deep over bedrock, and Littlejohn soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Littlejohn soil. Available water capacity also is moderate. The effective rooting depth is 25 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir and Pacific silver fir. The common forest understory plants are western swordfern, Oregongrape, vine maple, salal, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 144. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 150 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher

on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

121—Littlejohn gravelly sandy loam, 30 to 65 percent slopes. This well drained soil is on mountain back slopes and ridges. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and pumice over residuum and colluvium derived from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark yellowish brown gravelly sandy loam 11 inches thick. The subsoil is dark yellowish brown very gravelly loam 6 inches thick. The substratum is olive brown very gravelly loam 13 inches thick. Fractured andesite is at a depth of about 30 inches. The depth to andesite ranges from 25 to 40 inches. In some areas the surface layer is cindery loamy sand or gravelly loam. In other areas the soil is 40 to 60 inches deep over bedrock, is moderately well drained, has less than 35 percent rock fragments in the solum or substratum, or is underlain by breccia.

Included in this unit are small areas of Dobbs, Jonas, and Pheeney soils, soils that are 10 to 20 inches deep over bedrock, and Littlejohn soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Littlejohn soil. Available water capacity also is moderate. The effective rooting depth is 25 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir and

Pacific silver fir. The common forest understory plants are western swordfern, Oregon grape, vine maple, salal, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 144. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 150 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock,

trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

122—Littlejohn gravelly sandy loam, windswept, 30 to 65 percent slopes. This well drained soil is on mountain back slopes and ridges. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and pumice over residuum and colluvium derived from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark yellowish brown gravelly sandy loam 11 inches thick. The subsoil is dark yellowish brown very gravelly loam 6 inches thick. The substratum is olive brown very gravelly loam 13 inches thick. Fractured andesite is at a depth of about 30 inches. The depth to andesite ranges from 25 to 40 inches. In some areas the surface layer is cindery loamy sand or gravelly loam. In other areas the soil is 40 to 60 inches deep over bedrock, is moderately well drained, has less than 35 percent rock fragments in the solum or substratum, or is underlain by breccia.

Included in this unit are small areas of Dobbs, Jonas, and Pheeney soils, soils that are 10 to 20 inches deep over bedrock, and Littlejohn soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Littlejohn soil. Available water capacity also is moderate. The effective rooting depth is 25 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir and Pacific silver fir. The common forest understory plants are western swordfern, Oregongrape, vine maple, salal, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 117. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit. The trees are desiccated in

winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

123—Littlejohn gravelly sandy loam, tuff substratum, 8 to 30 percent slopes. This well drained soil is on mountain back slopes and ridges. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and pumice over residuum and colluvium

derived from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark yellowish brown gravelly sandy loam 7 inches thick. The upper 6 inches of the subsoil is olive brown gravelly sandy loam. The lower 5 inches is dark yellowish brown very gravelly sandy loam. The substratum also is dark yellowish brown very gravelly sandy loam. It is 9 inches thick. Fractured breccia is at a depth of about 27 inches. The depth to breccia ranges from 25 to 40 inches. In some areas the surface layer is cindery loamy sand or gravelly loam. In other areas the soil is 40 to 60 inches deep over bedrock, is moderately well drained, has less than 35 percent rock fragments in the solum or substratum, or is underlain by andesite.

Included in this unit are small areas of Dobbs, Jonas, and Pheeney soils, soils that are 10 to 20 inches deep over bedrock, and Littlejohn soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Littlejohn soil. Available water capacity is low. The effective rooting depth is 25 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir and Pacific silver fir. The common forest understory plants are western swordfern, Oregon grape, vine maple, salal, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 144. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 150 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road

construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

124—Littlejohn gravelly sandy loam, tuff substratum, 30 to 65 percent slopes. This well drained soil is on mountain back slopes and ridges. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and pumice over residuum and colluvium derived from breccia. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark yellowish brown gravelly sandy loam 7 inches thick. The upper 6 inches of the subsoil is olive brown gravelly sandy loam. The lower 5 inches is dark

yellowish brown very gravelly sandy loam. The substratum also is dark yellowish brown very gravelly sandy loam. It is 9 inches thick. Fractured breccia is at a depth of about 27 inches. The depth to breccia ranges from 25 to 40 inches. In some areas the surface layer is cindery loamy sand or gravelly loam. In other areas the soil is 40 to 60 inches deep over bedrock, is moderately well drained, has less than 35 percent rock fragments in the solum or substratum, or is underlain by andesite.

Included in this unit are small areas of Dobbs, Jonas, and Pheeney soils, soils that are 10 to 20 inches deep over bedrock, and Littlejohn soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Littlejohn soil. Available water capacity is low. The effective rooting depth is 25 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir and Pacific silver fir. The common forest understory plants are western swordfern, Oregongrape, vine maple, salal, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 144. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 150 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding

paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

125—Littlejohn gravelly sandy loam, tuff substratum, windswept, 30 to 65 percent slopes. This well drained soil is on mountain back slopes and ridges. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and pumice over residuum and colluvium derived from tuff and breccia. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark yellowish brown gravelly sandy loam 11 inches thick. The upper 6 inches of the subsoil is olive brown very gravelly sandy loam. The lower 6 inches is dark yellowish brown very gravelly sandy loam. The substratum also is dark yellowish brown very gravelly sandy loam. It is 7 inches thick. Fractured breccia is at a depth of about 30 inches. The depth to breccia ranges from 25 to 40 inches. In some areas the surface layer is cindery loamy sand or gravelly loam. In other areas the soil is 40 to 60 inches deep over bedrock, is

moderately well drained, has less than 35 percent rock fragments in the solum or substratum, or is underlain by andesite.

Included in this unit are small areas of Dobbs, Jonas, and Pheeney soils, soils that are 10 to 20 inches deep over bedrock, and Littlejohn soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Littlejohn soil. Available water capacity is low. The effective rooting depth is 25 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir and Pacific silver fir. The common forest understory plants are western swordfern, Oregongrape, vine maple, salal, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 117. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks

are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

126—Littlejohn-Rock outcrop complex, 30 to 90 percent slopes. This map unit is on glacially modified mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 160 days.

This unit is 50 percent Littlejohn gravelly sandy loam and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Dobbs, Jonas, and Pheeney soils, talus, soils that are 10 to 20 inches deep over bedrock, and Littlejohn soils that have slopes of less than 30 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Littlejohn soil is moderately deep to bedrock and is well drained. It formed in a mixture of volcanic ash and pumice over residuum and colluvium derived dominantly from igneous rocks. Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark yellowish brown gravelly sandy loam 11 inches thick. The subsoil is dark yellowish brown very gravelly loam 6 inches thick. The substratum is olive brown very gravelly loam 13 inches

thick. Fractured bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 25 to 40 inches. In some areas the surface layer is cindery loamy sand or gravelly loam. In other areas the soil is 40 to 60 inches deep over bedrock, is moderately well drained, or has less than 35 percent rock fragments in the solum or substratum.

Permeability is moderate in the Littlejohn soil. Available water capacity is low. The effective rooting depth is 25 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

Typically, the Rock outcrop is igneous rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir and Pacific silver fir. The common forest understory plants are western swordfern, Oregongrape, vine maple, salal, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 144. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 150 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. Yields are reduced by the Rock outcrop, which makes up about 30 percent of this unit.

The main limitations affecting timber harvesting are the Rock outcrop, the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil

is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Littlejohn soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

127—Lynnwood loamy fine sand, 6 to 15 percent slopes. This very deep, somewhat excessively drained soil is on outwash terraces. It formed in glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 50 to 300 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 49 degrees F. The average frost-free period is about 190 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown loamy fine sand. The upper 15 inches of the subsoil is dark yellowish brown loamy fine sand. The lower 5 inches is olive brown fine sand. The substratum to a depth of 60 inches is olive fine sand. In some areas the surface layer is sandy loam or loam. In other areas the soil has 15 to 25 percent pebbles in the substratum or is 14 to 24 inches deep to loamy sand or sand.

Included in this unit are small areas of Barneston,

Neilton, and Ragnar soils and Lynnwood soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is rapid in the Lynnwood soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used as pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used as woodland, hayland, or pasture. In the areas used for hay and pasture, the main limitations are the moderate available water capacity and the slope.

Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, and western redcedar. The common forest understory plants are western swordfern, brackenfern, ladyfern, deer fern, red huckleberry, and salal.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 154. On the basis of a 50-year site curve, it is 121. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 163 cubic feet per acre per year, occurring at age 60.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and establishment are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVs.

128—Marblemount gravelly loamy sand, 8 to 30 percent slopes. This moderately deep, well drained soil is on glacially modified mountain back slopes. It formed in a mixture of volcanic ash, glacial till, and colluvium derived dominantly from granite and low-grade metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown gravelly loamy sand. The upper 17 inches of the subsoil is variegated reddish brown and strong brown very gravelly loamy sand. The lower 13 inches is brown extremely gravelly loamy sand. Fractured granite is at a depth of about 35 inches. The depth to granite or metamorphic rocks ranges from 20 to 40 inches. In some areas the surface layer is loamy sand. In other areas the soil is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Philippa soils, soils that are 10 to 20 inches deep over bedrock, and Marblemount soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Marblemount soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are Pacific silver fir and western redcedar. The common forest understory plants are western swordfern, salal, Pacific trillium, Oregon grape, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index is 117 for western hemlock and 129 for Douglas fir. On the basis of a 50-year site curve, it is 85 for western hemlock and 107 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 174 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 128 cubic feet per acre per year, occurring at age 70.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because

most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting western hemlock, Douglas fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

129—Marblemount gravelly loamy sand, 30 to 65 percent slopes. This moderately deep, well drained soil is on glacially modified mountain back slopes. It formed in a mixture of volcanic ash, glacial till, and colluvium derived dominantly from granite and low-grade metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown gravelly loamy sand. The upper 17 inches of the subsoil is variegated reddish brown and strong brown very gravelly loamy sand. The lower 13 inches is brown extremely gravelly loamy sand. Fractured granite is at a depth of about 35 inches. The depth to granite or metamorphic rocks ranges from 20 to 40 inches. In some areas the surface layer is loamy sand. In other areas the soil is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Philippa soils,

soils that are 10 to 20 inches deep over bedrock, and Marblemount soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Marblemount soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are Pacific silver fir and western redcedar. The common forest understory plants are western swordfern, salal, Pacific trillium, Oregongrape, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index is 117 for western hemlock and 129 for Douglas fir. On the basis of a 50-year site curve, it is 85 for western hemlock and 107 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 174 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 128 cubic feet per acre per year, occurring at age 70.

The main limitations affecting timber harvesting are occasional snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and

naturally established seedlings. Reforestation can be accomplished by planting western hemlock, Douglas fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

130—Marblemount gravelly loamy sand, schist substratum, 30 to 65 percent slopes. This moderately deep, well drained soil is on glacially modified mountain back slopes. It formed in a mixture of volcanic ash, glacial till, and colluvium derived dominantly from schist. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of organic material 5 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown gravelly loamy sand. The subsoil is dark brown very gravelly loamy sand 9 inches thick. The substratum is 22 inches of variegated very gravelly and extremely gravelly loamy sand. Weathered schist is at a depth of about 38 inches. The depth to weathered schist ranges from 20 to 40 inches. In some areas the surface layer is loamy sand. In other areas the soil is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Philippa soils, soils that are 10 to 20 inches deep over bedrock, and Marblemount soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid in the Marblemount soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are Pacific silver fir and western redcedar. The common forest understory plants are western swordfern, salal, Pacific trillium, Oregongrape, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index is 117 for western hemlock and 129 for Douglas fir. On the basis of a 50-year site curve, it is 85 for western hemlock and 107 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 174 cubic feet per acre per year,

occurring at age 50. For Douglas fir it is 128 cubic feet per acre per year, occurring at age 70.

The main limitations affecting timber harvesting are occasional snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality schist. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting western hemlock, Douglas fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIs.

131—Marblemount-Rock outcrop complex, 45 to 90 percent slopes. This map unit is on glacially modified mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 120 days.

This unit is 50 percent Marblemount gravelly loamy sand and 40 percent Rock outcrop. The components of

this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Philippa soils, talus, soils that are 10 to 20 inches deep over bedrock, and Marblemount soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Marblemount soil is moderately deep and well drained. It formed in a mixture of volcanic ash, glacial till, and colluvium derived dominantly from granite and low-grade metamorphic rocks. Typically, the surface is covered with a mat of organic material 2 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown gravelly loamy sand. The upper 17 inches of the subsoil is variegated reddish brown and strong brown very gravelly loamy sand. The lower 13 inches is brown extremely gravelly loamy sand. Fractured granite is at a depth of about 35 inches. The depth to granite or metamorphic rocks ranges from 20 to 40 inches. In some areas the surface layer is loamy sand. In other areas the soil is 40 to 60 inches deep over bedrock.

Permeability is moderately rapid in the Marblemount soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is granite or low-grade metamorphic rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are Pacific silver fir and western redcedar. The common forest understory plants are western swordfern, salal, Pacific trillium, Oregongrape, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index is 117 for western hemlock and 129 for Douglas fir. On the basis of a 50-year site curve, it is 85 for western hemlock and 107 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 174 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 128 cubic feet per acre per year, occurring at age 70. Yields are reduced by the Rock outcrop, which makes up about 40 percent of this unit.

The main limitations affecting timber harvesting are the occasional snowpack, the Rock outcrop, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems

generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite or metamorphic rock. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting western hemlock, Douglas fir, or Pacific silver fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Marblemount soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

132—Mashel silt loam, 5 to 30 percent slopes. This very deep, moderately well drained soil is on back slopes in the foothills. It formed in glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 700 to 1,800 feet. The average annual precipitation is about 55 inches, and the average annual air

temperature is about 49 degrees F. The average frost-free period is about 190 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark grayish brown silt loam 7 inches thick. The upper 6 inches of the subsoil is brown silt loam. The next 17 inches is brown silty clay loam and silty clay. The lower part to a depth of 60 inches is grayish brown silty clay. In some areas the surface layer is loam, gravelly loam, or gravelly silt loam. In other areas the subsoil has 15 to 35 percent rock fragments and 10 to 18 percent clay throughout or has 18 to 35 percent clay in the lower part.

Included in this unit are small areas of Cinebar, Scamman, and Wilkeson soils and Mashel soils that have slopes of more than 30 percent or less than 5 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately slow in the Mashel soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and red alder are the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and bigleaf maple. The common forest understory plants are vine maple, Oregon oxalis, western swordfern, longtube twinflower, western brackenfern, blackberry, and red huckleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 162. On the basis of a 50-year site curve, it is 123. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 172 cubic feet per acre per year, occurring at age 65. Estimates of the site index and growth rate of red alder have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of

compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

133—Mashel silt loam, 30 to 65 percent slopes.

This very deep, moderately well drained soil is on back slopes in the foothills. It formed in glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 700 to 1,800 feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 49 degrees F. The average frost-free period is about 190 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark grayish brown silt loam 7 inches thick. The upper 6 inches of the subsoil is brown silt loam. The next 17 inches is brown silty clay loam and silty clay. The lower part to a depth of 60 inches is grayish brown silty clay. In some areas the surface layer is loam, gravelly loam, or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil, has 10 to 18 percent clay in the subsoil, or has 18 to 35 percent clay in the lower part of the substratum.

Included in this unit are small areas of Cinebar, Scamman, and Wilkeson soils and Mashel soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately slow in the Mashel soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and red alder are the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and bigleaf maple. The common forest understory plants are vine maple, Oregon oxalis, western swordfern, longtube twinflower, western brackenfern, blackberry, and red huckleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 162. On the basis of a 50-year site curve, it is 123. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 172

cubic feet per acre per year, occurring at age 65. Estimates of the site index and growth rate of red alder have not been made.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

134—Melakwa sandy loam, 8 to 30 percent slopes.

This moderately deep, well drained soil is on glacially modified mountain back slopes and toe slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown sandy loam. The upper 15 inches of the subsoil is dark brown and dark yellowish brown very gravelly sandy loam. The lower 9 inches is olive brown very gravelly loam. The substratum is light olive brown

extremely gravelly loam 6 inches thick. Hard, fractured andesite is at a depth of about 37 inches. The depth to fractured andesite ranges from 20 to 40 inches. In some areas the soil has a substratum of loamy sand, is 40 to 60 inches deep over bedrock, is underlain by breccia, or has 15 to 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Kaleetan, Littlejohn, Marblemount, Philippa, and Pitcher soils, poorly drained soils in depressions, and Melakwa soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Melakwa soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are western swordfern, Oregongrape, salal, vine maple, red huckleberry, Pacific trillium, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 128. On the basis of a 50-year site curve, it is 104. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 127 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production.

Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

135—Melakwa sandy loam, 30 to 65 percent slopes. This moderately deep, well drained soil is on glacially modified mountain back slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown sandy loam. The upper 15 inches of the subsoil is dark brown and dark yellowish brown very gravelly sandy loam. The lower 9 inches is olive brown very gravelly loam. The substratum is light olive brown extremely gravelly loam 6 inches thick. Hard, fractured andesite is at a depth of about 37 inches. The depth to fractured andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil has a substratum of loamy sand, is 40 to 60 inches deep over bedrock, is underlain by breccia, or has 15 to 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Kaleetan, Littlejohn, Marblemount, Philippa, and Pitcher soils and Melakwa soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Melakwa soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are western swordfern, Oregongrape, salal, vine maple, red

huckleberry, Pacific trillium, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 128. On the basis of a 50-year site curve, it is 104. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 127 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

136—Melakwa sandy loam, windswept, 30 to 65 percent slopes. This moderately deep, well drained soil is on glacially modified mountain back slopes and toe

slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown sandy loam. The upper 15 inches of the subsoil is dark brown and dark yellowish brown very gravelly sandy loam. The lower 9 inches is olive brown very gravelly loam. The substratum is light olive brown extremely gravelly loam 6 inches thick. Hard, fractured andesite is at a depth of about 37 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil has a substratum of loamy sand, is 40 to 60 inches deep over bedrock, is underlain by breccia, or has 15 to 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Kaleetan, Littlejohn, Marblemount, Philippa, and Pitcher soils and Melakwa soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Melakwa soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are western swordfern, Oregongrape, salal, vine maple, red huckleberry, Pacific trillium, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 117. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer

and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

137—Melakwa sandy loam, tuff substratum, 30 to 65 percent slopes. This moderately deep, well drained soil is on glacially modified mountain back slopes and toe slopes. It formed in a mixture of volcanic ash and pumice over colluvium derived from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown sandy loam. The upper 10 inches of the subsoil is dark yellowish brown very gravelly loam. The lower 13 inches is olive brown very gravelly loam. Hard breccia is at a depth of about 31 inches. The depth to breccia ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil has a

substratum of loamy sand, is 40 to 60 inches deep over bedrock, is underlain by andesite, or has 15 to 35 percent rock fragments in the solum or substratum.

Included in this unit are small areas of Kaleetan, Littlejohn, Marblemount, Philippa, and Pitcher soils and Melakwa soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Melakwa soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are western swordfern, Oregongrape, salal, vine maple, red huckleberry, Pacific trillium, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 128. On the basis of a 50-year site curve, it is 104. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 127 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be

expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

138—Melakwa-Rock outcrop complex, 45 to 90 percent slopes. This map unit is on glacially modified mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

This unit is 50 percent Melakwa sandy loam and 40 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Kaleetan, Littlejohn, Marblemount, Philippa, and Pitcher soils, talus, soils that are 10 to 20 inches deep over bedrock, and Melakwa soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Melakwa soil is moderately deep and well drained. It formed in a mixture of volcanic ash and pumice over colluvium derived from andesite. Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown sandy loam. The upper 15 inches of the subsoil is dark brown and dark yellowish brown very gravelly sandy loam. The lower 9 inches is olive brown very gravelly loam. The substratum is light olive brown extremely gravelly loam 6 inches thick. Hard, fractured andesite is at a depth of about 37 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, gravelly sandy loam, or gravelly loamy sand. In other areas the soil has a substratum of loamy sand, is 40 to 60 inches deep over bedrock, is underlain by

breccia, or has 15 to 35 percent rock fragments in the solum or substratum.

Permeability is moderate in the Melakwa soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

Typically, the Rock outcrop is andesite. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are western swordfern, Oregongrape, salal, vine maple, red huckleberry, Pacific trillium, deer fern, longtube twinflower, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 128. On the basis of a 50-year site curve, it is 104. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 127 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of western hemlock have not been made. Yields are reduced by the Rock outcrop, which makes up about 40 percent of this unit.

The main limitations affecting timber harvesting are the Rock outcrop, the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of

erosion. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Melakwa soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

139—Mowich silt loam, 0 to 15 percent slopes.

This very deep, somewhat poorly drained soil is on proglacial lake plains. It formed in volcanic ash over glaciolacustrine sediments. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of organic material 8 inches thick. The surface layer is dark brown silt loam 7 inches thick. The upper 3 inches of the subsoil is strong brown silt loam. The lower 16 inches is dark yellowish brown, mottled silt loam. The substratum to a depth of 60 inches is light brownish gray, mottled silty clay. Depth to the substratum ranges from 20 to 35 inches. In some areas the surface layer is loam. In other areas the soil has 30 to 45 percent clay in the substratum or is 10 to 20 inches deep to the substratum.

Included in this unit are small areas of Pierking soils and organic soils. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Mowich soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a

depth of 1 to 2 feet from November through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are salal, western swordfern, Oregongrape, red huckleberry, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 156. On the basis of a 50-year site curve, it is 121. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 165 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are occasional snowpack and the muddiness caused by seasonal wetness. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the seasonal high water table, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVw.

140—Mukilteo peat, 0 to 1 percent slopes. This very deep, very poorly drained soil is in bogs. It formed in herbaceous and woody organic material. Areas are oval or elongated and are 5 to 80 acres in size. The native vegetation is mainly shrubs and forbs. Elevation is 600 to 1,000 feet. The average annual precipitation is about 50 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface layer is dark brown peat 10 inches thick. The underlying material to a depth of 60 inches is dark brown and dark reddish brown hemic material. In some areas the surface layer is mucky peat.

Included in this unit are small areas of Norma, Seattle, and Shalcar soils and Barneston, Ogarty, and Tokul soils on the adjacent uplands. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Mukilteo soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at or above the surface from November through May. Runoff is very slow, and there is no hazard of erosion.

This unit is used for wildlife habitat. The native vegetation includes willows, sedges, cattail, hardhack, and rushes. The unit is unsuited to the production of commercial trees.

This unit is in capability subclass VIIw.

141—Nagrom sandy loam, 8 to 30 percent slopes. This well drained soil is on ridge crests and mountain back slopes. It is moderately deep to fractured bedrock. It formed in volcanic ash and pumice over colluvium and residuum derived dominantly from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 2,400 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of leaves, needles, twigs, and moss 1.5 inches thick. When mixed to a depth of 4 inches, the surface layer is dark brown sandy loam. The upper 3 inches of the subsoil is dark reddish brown loam. The lower 16 inches is dark yellowish brown very gravelly loam. The substratum is yellowish brown very gravelly loam 15 inches thick. Fractured andesite is at a depth of about 38 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, loam, or gravelly loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Nimue and

Playco soils, soils that are 10 to 20 inches deep to andesite, and Nagrom soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nagrom soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are western swordfern, trillium, huckleberry, salal, deer fern, common beargrass, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 109. On the basis of a 50-year site curve, it is 77. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 158 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by

planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

142—Nagrom sandy loam, 30 to 65 percent slopes.

This well drained soil is on ridge crests and mountain back slopes. It is moderately deep to fractured bedrock. It formed in volcanic ash and pumice over colluvium and residuum derived dominantly from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 2,400 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of leaves, needles, twigs, and moss 1.5 inches thick. When mixed to a depth of 4 inches, the surface layer is dark brown sandy loam. The upper 3 inches of the subsoil is dark reddish brown loam. The lower 16 inches is dark yellowish brown very gravelly loam. The substratum is yellowish brown very gravelly loam 15 inches thick. Fractured andesite is at a depth of about 38 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, loam, or gravelly loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Nimue and Playco soils, soils that are 10 to 20 inches deep to andesite, and Nagrom soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nagrom soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are western swordfern, trillium, huckleberry, salal, deer fern, common beargrass, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 109. On the basis of a 50-year site curve, it is 77. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 158 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds

are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

143—Nagrom gravelly loam, tuff substratum, 8 to 30 percent slopes. This well drained soil is on ridge crests and mountain back slopes. It is moderately deep to fractured bedrock. It formed in volcanic ash and pumice over colluvium and residuum derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 2,400 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42

degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of leaves, needles, twigs, and moss 4 inches thick. The surface layer is very dark brown gravelly loam 4 inches thick. The upper 6 inches of the subsoil is dark brown gravelly loam. The lower 15 inches is strong brown very gravelly sandy loam and dark yellowish brown very gravelly loam. The substratum is yellowish brown extremely gravelly silt loam 9 inches thick. Weathered breccia is at a depth of about 34 inches. The depth to breccia or tuff ranges from 20 to 40 inches. In some areas the surface layer is sandy loam or loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil, is 40 to 60 inches deep to breccia or tuff, or is underlain by andesite.

Included in this unit are small areas of Nimue and Playco soils, soils that are 10 to 20 inches deep to breccia or tuff, and Nagrom soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nagrom soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are western swordfern, trillium, huckleberry, salal, deer fern, common beargrass, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 126. On the basis of a 50-year site curve, it is 90. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 192 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill

slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

144—Nagrom gravelly loam, tuff substratum, 30 to 65 percent slopes. This well drained soil is on ridge crests and mountain back slopes. It is moderately deep to fractured bedrock. It formed in volcanic ash and pumice over colluvium and residuum derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 2,400 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of leaves, needles, twigs, and moss 4 inches thick. The surface layer is very dark brown gravelly loam 4 inches thick. The upper 6 inches of the subsoil is dark brown gravelly loam. The lower 15 inches is strong brown very gravelly sandy loam and dark yellowish brown very gravelly loam. The substratum is yellowish brown extremely gravelly silt loam 9 inches thick. Weathered breccia is at a depth of about 34 inches. The depth to breccia or tuff ranges from 20 to 40 inches. In some areas the surface layer is sandy loam or loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil, is 40 to 60 inches deep to

breccia or tuff, or is underlain by andesite.

Included in this unit are small areas of Nimue and Playco soils, soils that are 10 to 20 inches deep to breccia or tuff, and Nagrom soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nagrom soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are western swordfern, trillium, huckleberry, salal, deer fern, common beargrass, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 126. On the basis of a 50-year site curve, it is 90. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 192 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is

established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

145—Nagrom-Rock outcrop complex, 30 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 2,400 to 3,600 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

This unit is 50 percent Nagrom sandy loam and 40 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Nimue, Playco, and Reggad soils, talus, soils that are 10 to 20 inches deep over bedrock, and Nagrom soils that have slopes of less than 30 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Nagrom soil is moderately deep to fractured bedrock and is well drained. It formed in volcanic ash and pumice over colluvium and residuum derived dominantly from extrusive igneous rocks. Typically, the surface is covered with a mat of leaves, needles, twigs, and moss 1.5 inches thick. When mixed to a depth of 4 inches, the surface layer is dark brown sandy loam. The upper 3 inches of the subsoil is dark reddish brown loam. The lower 16 inches is dark yellowish brown very gravelly loam. The substratum is yellowish brown very gravelly loam 15 inches thick. Fractured andesite is at a depth of about 38 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, loam, or gravelly loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Permeability is moderate in the Nagrom soil.

Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is andesite. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are western swordfern, trillium, huckleberry, salal, deer fern, common beargrass, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 109. On the basis of a 50-year site curve, it is 77. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 158 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 40 percent of this unit.

The main limitations affecting timber harvesting are snowpack, the Rock outcrop, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is

established. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Nagrom soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

146—Nargar fine sandy loam, 0 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in a mixture of volcanic ash and sandy alluvium over glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 700 to 1,200 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. The surface layer is dark brown fine sandy loam 2 inches thick. The subsoil is strong brown and yellowish brown fine sandy loam 22 inches thick. The substratum to a depth of 60 inches is olive brown sand. In some areas the surface layer is loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Barneston, Lynnwood, and Pastik soils and Nargar soils that have slopes of more than 15 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the upper part of the Nargar soil and rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used for hay or pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used mainly as woodland. It also is used for hay and pasture.

In the areas used for hay and pasture, the main limitations are soil compaction, the hazard of erosion,

and the moderate available water capacity. Proper stocking rates, pasture rotation, and restricted grazing during short wet periods help to keep the pasture in good condition and help to control runoff and erosion. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, and western redcedar. The common forest understory plants are western swordfern, red huckleberry, ladyfern, vine maple, salal, deer fern, salmonberry, western brackenfern, trailing blackberry, and Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 177. On the basis of a 50-year site curve, it is 134. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 188 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Extra rock is needed to maintain a stable and uniform road surface. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist, a high degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIe.

147—Nargar fine sandy loam, 15 to 30 percent slopes. This very deep, well drained soil is on terraces. It formed in a mixture of volcanic ash and sandy alluvium over glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 700 to 1,200

feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. The surface layer is dark brown fine sandy loam 2 inches thick. The subsoil is strong brown and yellowish brown fine sandy loam 22 inches thick. The substratum to a depth of 60 inches is olive brown sand. In some areas the surface layer is loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Barneston, Lynnwood, and Pastik soils and Nargar soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the upper part of the Nargar soil and rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, and western redcedar. The common forest understory plants are western swordfern, red huckleberry, ladyfern, vine maple, salal, deer fern, salmonberry, western brackenfern, trailing blackberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 177. On the basis of a 50-year site curve, it is 134. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 188 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Extra rock is needed to maintain a stable and uniform road surface. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist, a high degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can

reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

148—Nargar-Pastik complex, 35 to 70 percent slopes. This map unit is on terrace escarpments. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,200 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 160 days.

This unit is 45 percent Nargar fine sandy loam and 45 percent Pastik silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Barneston, Lynnwood, and Tokul soils and Nargar and Pastik soils that have slopes of more than 70 percent or less than 35 percent. Included areas make up about 10 percent of the total acreage.

The Nargar soil is very deep and well drained. It formed in a mixture of volcanic ash and sandy alluvium over glacial outwash. Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. The surface layer is dark brown fine sandy loam 2 inches thick. The subsoil is strong brown and yellowish brown fine sandy loam 22 inches thick. The substratum to a depth of 60 inches is olive brown sand. In some areas the surface layer is loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil or substratum.

Permeability is moderate in the upper part of the Nargar soil and rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Pastik soil is very deep and moderately well drained. It formed in lake sediments and volcanic ash. Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown silt loam 6 inches thick. The upper 6 inches

of the subsoil also is dark brown silt loam. The lower 19 inches is dark yellowish brown and yellowish brown very fine sandy loam. The substratum to a depth of 60 inches is olive brown and light brownish gray very fine sandy loam. In some areas the surface layer is sandy loam or loam. In other areas the substratum is silty clay.

Permeability is slow in the Pastik soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 1.5 to 2.5 feet from December through May. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, red huckleberry, ladyfern, vine maple, salal, deer fern, salmonberry, western brackenfern, trailing blackberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 177 on both soils. On the basis of a 50-year site curve, it is 134 on the Nargar soil and 132 on the Pastik soil. On the basis of a 100-year site curve, the mean site index for western hemlock on the Pastik soil is 176. On the basis of a 50-year site curve, it is 123. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 188 cubic feet per acre per year, occurring at age 60 on both soils. For western hemlock it is 285 cubic feet per acre per year, occurring at age 50 on the Pastik soil.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soils are moist, a high degree of puddling when the soils are wet, and a moderate degree of soil displacement when the soils are dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in

productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table in the Pastik soil, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

149—National cindery sandy loam, 0 to 8 percent slopes. This very deep, well drained soil is on terraces. It formed in a mixture of volcanic ash and pumice over alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 1,200 to 1,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 165 days.

Typically, the surface is covered with a mat of leaves and twigs 2 inches thick. The surface layer is very dark grayish brown cindery sandy loam 10 inches thick. The upper 18 inches of the subsoil is dark brown and dark yellowish brown very cindery loamy sand. The lower 18 inches is dark yellowish brown loam. The substratum to a depth of 60 inches is dark yellowish brown silt loam. In some areas the surface layer is very cindery sandy loam or cindery loamy sand. In other areas the soil has 15 to 50 percent rock fragments in the lower part of the subsoil and in the substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Greenwater soils and National soils that have slopes of more than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is rapid in the upper part of the National soil and moderate in the lower part of the subsoil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 5 to 6 feet from December through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. If irrigated, it also is suitable as pasture and hayland.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, red alder, and black cottonwood. The common forest understory plants are Oregon oxalis,

western brackenfern, western swordfern, trailing blackberry, red huckleberry, bedstraw, vine maple, Pacific trillium, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 164. On the basis of a 50-year site curve, it is 127. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 174 cubic feet per acre per year, occurring at age 60.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir and red alder occurs readily. Seedlings that are planted or naturally established in the less fertile upper part of the subsoil grow poorly and lack vigor. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

This unit is in capability subclass IIIe.

150—Neilton gravelly loamy sand, 2 to 15 percent slopes. This very deep, excessively drained soil is on terraces. It formed in glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 400 to 500 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 180 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is very dark brown gravelly loamy sand 2 inches thick. The upper 14 inches of the subsoil is dark yellowish brown gravelly loamy sand. The lower 5 inches is dark brown extremely gravelly sand. The substratum to a depth of 60 inches is dark brown very gravelly sand. The depth to very gravelly sand ranges from 15 to 25 inches. In some areas the surface layer is very gravelly loamy sand.

Included in this unit are small areas of Alderwood, Lynnwood, and Norma soils and Neilton soils that have slopes of more than 15 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very rapid in the Neilton soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used for hay and pasture. In the areas used for hay and pasture, the main limitation is the low available water capacity. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are grand fir, western hemlock, and western redcedar. The common forest understory plants are Oregongrape, western brackenfern, salal, prince's pine, western swordfern, trailing blackberry, red huckleberry, creambush oceanspray, and northern twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 141. On the basis of a 50-year site curve, it is estimated to be 105. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 146 cubic feet per acre per year, occurring at age 65.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from

unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of planted Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VI.

151—Nimue loamy sand, 6 to 30 percent slopes.

This very deep, well drained soil is on rounded ridgetops and mountain back slopes. It formed in a thin mantle of volcanic ash and pumice over colluvium and material weathered from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown loamy sand. The upper 5 inches of the subsoil is reddish brown and strong brown sandy loam. The lower 14 inches is brown very gravelly loam. The substratum to a depth of 60 inches is dark yellowish brown and olive brown extremely gravelly silt loam. In some areas the surface layer is sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Foss, Haywire, and Playco soils and Nimue soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nimue soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are salal, western swordfern, Oregongrape, Pacific yew, common beargrass, red huckleberry, dwarf huckleberry, and woodrush.

On the basis of a 100-year site curve, the mean site

index for western hemlock is 101. On the basis of a 50-year site curve, it is 71. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIe.

152—Nimue loamy sand, 30 to 65 percent slopes.

This very deep, well drained soil is on rounded ridgetops and mountain back slopes. It formed in a thin mantle of volcanic ash and pumice over colluvium and material weathered from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The

average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown loamy sand. The upper 5 inches of the subsoil is reddish brown and strong brown sandy loam. The lower 14 inches is brown very gravelly loam. The substratum to a depth of 60 inches is dark yellowish brown and olive brown extremely gravelly silt loam. In some areas the surface layer is sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Foss, Haywire, and Playco soils and Nimue soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nimue soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are salal, western swordfern, Oregongrape, Pacific yew, common beargrass, red huckleberry, dwarf huckleberry, and woodrush.

On the basis of a 100-year site curve, the mean site index for western hemlock is 101. On the basis of a 50-year site curve, it is 71. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIIe.

153—Nimue loamy sand, 65 to 90 percent slopes.

This very deep, well drained soil is on mountain back slopes. It formed in a thin mantle of volcanic ash and pumice over colluvium and material weathered from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown loamy sand. The upper 5 inches of the subsoil is reddish brown and strong brown sandy loam. The lower 14 inches is brown very gravelly loam. The substratum to a depth of 60 inches is dark yellowish brown and olive brown extremely gravelly silt loam. In some areas the surface layer is sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Foss, Haywire, and Playco soils and Nimue soils that have slopes of less than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nimue soil. Available

water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are salal, western swordfern, Oregon grape, Pacific yew, common beargrass, red huckleberry, dwarf huckleberry, and woodrush.

On the basis of a 100-year site curve, the mean site index for western hemlock is 101. On the basis of a 50-year site curve, it is 71. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation

of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIIe.

154—Nimue loamy sand, tuff substratum, 8 to 30 percent slopes. This very deep, well drained soil is on rounded ridgetops and mountain back slopes. It formed in a thin mantle of volcanic ash and pumice over colluvium and material weathered from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown loamy sand. The upper 9 inches of the subsoil is dark yellowish brown sandy loam. The lower 10 inches is dark brown very gravelly sandy loam. The upper 7 inches of the substratum is strong brown very gravelly loam. The lower part to a depth of 60 inches is yellowish brown extremely gravelly loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil, is 40 to 60 inches deep to breccia or tuff, or is underlain by andesite.

Included in this unit are small areas of Foss, Haywire, and Playco soils and Nimue soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nimue soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are salal, western swordfern, Oregon grape, Pacific yew, common beargrass, red huckleberry, dwarf huckleberry, and woodrush.

On the basis of a 100-year site curve, the mean site index for western hemlock is 101. On the basis of a 50-year site curve, it is 71. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIe.

155—Nimue loamy sand, tuff substratum, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in a thin mantle of volcanic ash and pumice over colluvium and material weathered from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish

brown loamy sand. The upper 9 inches of the subsoil is dark yellowish brown sandy loam. The lower 10 inches is dark brown very gravelly sandy loam. The upper 7 inches of the substratum is strong brown very gravelly loam. The lower part to a depth of 60 inches is yellowish brown extremely gravelly loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil, is 40 to 60 inches deep to breccia or tuff, or is underlain by andesite.

Included in this unit are small areas of Foss, Haywire, and Playco soils and Nimue soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nimue soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are salal, western swordfern, Oregongrape, Pacific yew, common beargrass, red huckleberry, dwarf huckleberry, and woodrush.

On the basis of a 100-year site curve, the mean site index for western hemlock is 101. On the basis of a 50-year site curve, it is 71. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is

dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIIe.

156—Nimue-Rock outcrop complex, 30 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 120 days.

This unit is 60 percent Nimue loamy sand and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Foss, Haywire, and Playco soils, talus, soils that are 10 to 40 inches deep over bedrock, and Nimue soils that have slopes of less than 30 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Nimue soil is very deep and well drained. It formed in a mantle of volcanic ash and pumice over colluvium and material weathered from extrusive igneous rocks. Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 5 inches, the surface layer is dark reddish brown loamy sand. The upper 5 inches of the subsoil is reddish brown and strong brown sandy loam. The lower 14 inches is brown very gravelly loam. The substratum to a depth of 60 inches is dark yellowish brown and olive brown extremely gravelly silt loam. In some areas the surface layer is sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Permeability is moderate in the Nimue soil. Available

water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is andesite. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Alaska cedar. The common forest understory plants are salal, western swordfern, Oregon grape, Pacific yew, common beargrass, red huckleberry, dwarf huckleberry, and woodrush.

On the basis of a 100-year site curve, the mean site index for western hemlock is 101. On the basis of a 50-year site curve, it is 71. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 30 percent of this unit.

The main limitations affecting timber harvesting are snowpack, the Rock outcrop, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation.

The Nimue soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

157—Nooksack silt loam, 0 to 2 percent slopes.

This very deep, moderately well drained soil is on flood plains and river terraces. It formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 30 to 500 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 190 days.

Typically, the surface layer is very dark grayish brown silt loam 11 inches thick. The subsoil is dark grayish brown silt loam 18 inches thick. The substratum to a depth of 60 inches is dark grayish brown and grayish brown silt loam. In some areas the surface layer is very fine sandy loam. In other areas the soil has a substratum that is stratified with fine sandy loam and sand, has sand at a depth of 40 to 60 inches, or has less than 50 percent base saturation in the surface layer.

Included in this unit are small areas of Belfast, Oridia, Puget, and Sultan soils and Nooksack soils that have slopes of more than 2 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Nooksack soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 3 to 4 feet from February through May. Runoff is very slow, and there is no hazard of erosion. This soil is subject to occasional, brief periods of flooding from November through March.

This unit is used mainly as hayland, pasture, or cropland. It also is used as woodland and as a site for homes.

In the areas used for hay and pasture, the main hazard is the flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

The main hazard in the areas used as cropland is the flooding. This unit is suited to all of the crops commonly grown in the survey area. The principal crops are oats

and corn silage. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are trailing blackberry, salmonberry, western swordfern, red elderberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 160. On the basis of a 50-year site curve, it is estimated to be 120. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 170 cubic feet per acre per year, occurring at age 65.

The main limitations affecting timber harvesting are the muddiness caused by seasonal wetness and the flooding. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. The occasional flooding hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

In the areas used for homesite development, the main limitations are the flooding and the seasonal high water. The seasonal high water table increases the likelihood that septic tank absorption fields will fail. Installing the absorption field in fill approved by the health district helps to overcome these limitations.

This unit is in capability subclass IIIw.

158—Norma loam, 0 to 3 percent slopes. This very deep, poorly drained soil is in depressions on glacial till plains. It formed in alluvium. The native vegetation is mainly trees and shrubs. Elevation is 100 to 800 feet.

The average annual precipitation is about 50 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 180 days.

Typically, the surface layer is very dark grayish brown loam 9 inches thick. The subsoil is dark grayish brown gravelly loam 24 inches thick. The substratum to a depth of 60 inches is dark grayish brown very gravelly sandy loam. In some areas the surface layer is sandy loam or silt loam. In other areas the soil has a sandy substratum, has lenses of sandy material in the subsoil, has 15 to 25 percent clay in the substratum, has 35 to 50 percent pebbles in the subsoil, or has 15 to 35 percent pebbles in the substratum.

Included in this unit are small areas of Alderwood and Lynnwood soils and drained Norma soils. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Norma soil. Available water capacity is moderate. The effective rooting depth is limited by a seasonal high water table, which is at or above the surface from November through May. Runoff is very slow, and there is no hazard of erosion.

This unit is used as woodland, pasture, or hayland. In the areas used for hay and pasture, the main limitations are the seasonal high water table, soil compaction, and puddling. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Grazing when the soil is wet results in compaction of the surface layer and poor tilth. The water table limits the choice of forage species to grasses and shallow-rooted legumes unless the soil has been drained.

Red alder is the main woodland species. Among the trees of limited extent are western redcedar, bigleaf maple, and western hemlock. The common forest understory plants are skunk cabbage, stinging nettle, salmonberry, western swordfern, western brackenfern, trailing blackberry, thimbleberry, salal, Oregongrape, and vine maple.

On the basis of a 50-year site curve, the mean site index for red alder is 90. The highest average growth rate in unmanaged, even-aged stands of red alder is 101 cubic feet per acre per year, occurring at age 40.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and may be impassable during rainy periods. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist, a high degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting red alder or western redcedar seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIw.

159—Oakes gravelly loam, 6 to 30 percent slopes.

This very deep, well drained soil is on glacially modified mountain back slopes and toe slopes. It formed in a mixture of volcanic ash and colluvium and slope alluvium derived from glacial drift. The native vegetation is mainly conifers and shrubs. Elevation is 1,400 to 2,400 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 5 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown gravelly loam. The upper 14 inches of the subsoil is dark brown very gravelly loam. The lower 16 inches is dark yellowish brown very gravelly loam. The substratum to a depth of 60 inches is light olive brown very gravelly sandy loam. In some areas the surface layer is loam. In other areas the soil has a substratum of loamy sand, is 40 to 60 inches deep to dense glacial till or bedrock, or has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Elwell and Skykomish soils and Oakes soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Oakes soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar, red alder, and bigleaf maple. The common forest understory plants are salal, Oregon grape, western swordfern, western brackenfern, red huckleberry, vine maple, trailing blackberry, and tall blue huckleberry.

On the basis of a 100-year site curve, the mean site index is 152 for Douglas fir and 148 for western hemlock. On the basis of a 50-year site curve, it is 117 for Douglas fir and 105 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 161 cubic feet per acre per year, occurring at age 60. For western hemlock it is 234 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

160—Oakes cobbly loam, 6 to 30 percent slopes.

This deep, well drained soil is on mountain toe slopes. It formed in block-and-ash flow deposited over compact lahar or glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,400 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and moss 3 inches thick. The surface layer is dark yellowish brown cobbly loam 6 inches thick. The upper 17 inches of the subsoil is dark yellowish brown very cobbly silt loam. The lower 21 inches is yellowish brown very cobbly silt loam. Yellowish brown, compact lahar that crushes to very gravelly sandy loam is at a depth of about 44 inches. The depth to lahar ranges from 40 to 60 inches. The compact lahar is similar to a cemented pan. In some areas the surface layer is loam or stony loam. In other areas the compact lahar is below a depth of 60 inches.

Included in this unit are small areas of Jonas and Zynbar soils and Oakes soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Oakes soil and very slow in the compact lahar. Available water capacity is moderate. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar, red alder, and bigleaf maple. The common forest understory plants are western swordfern, Oregon grape, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index is 152 for Douglas fir and 148 for western hemlock. On the basis of a 50-year site curve, it is 117 for Douglas fir and 105 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 161 cubic feet per acre per year, occurring at age 60. For western hemlock it is 234 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. The cobbles on the surface hinder yarding. When felled, the timber can break on the cobbles. Unsurfaced roads are soft when wet and are subject to deep rutting during

rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. Because of the cobbles, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

161—Oakes cobbly loam, 30 to 65 percent slopes.

This deep, well drained soil is on mountain back slopes. It formed in block-and-ash flow deposited over compact lahar or glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,400 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and moss 3 inches thick. The surface layer is dark yellowish brown cobbly loam 6 inches thick. The upper 17 inches of the subsoil is dark yellowish brown very cobbly silt loam. The lower 21 inches is yellowish brown very cobbly silt loam. Yellowish brown, compact lahar that crushes to very gravelly sandy loam is at a depth of about 44 inches. The depth to lahar ranges from 40 to 60 inches. The compact lahar is similar to a cemented pan. In some areas the surface layer is loam or stony loam. In other areas the compact lahar is below a depth of 60 inches.

Included in this unit are small areas of Jonas and Zynbar soils and Oakes soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the

Oakes soil and very slow in the compact lahar.

Available water capacity is moderate. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar, red alder, and bigleaf maple. The common forest understory plants are western swordfern, Oregon grape, salal, red huckleberry, and vine maple.

On the basis of a 100-year site curve, the mean site index is 152 for Douglas fir and 148 for western hemlock. On the basis of a 50-year site curve, it is 117 for Douglas fir and 105 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 161 cubic feet per acre per year, occurring at age 60. For western hemlock it is 234 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. The cobbles hinder yarding. When felled, the timber can break on the cobbles. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. Because of the cobbles, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir or red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing

plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

162—Ogarty gravelly loam, 8 to 30 percent slopes.

This well drained soil is on back slopes in the foothills. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and colluvium and residuum derived dominantly from andesite and breccia. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1.5 inches thick. The surface layer is very dark grayish brown gravelly loam 4 inches thick. The upper 11 inches of the subsoil is dark brown very gravelly sandy loam. The lower 13 inches is dark yellowish brown and dark brown extremely gravelly fine sandy loam. The substratum is brown extremely gravelly fine sandy loam 9 inches thick. Fractured andesite is at a depth of about 37 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Barneston, Blethen, and Tokul soils and Ogarty soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Ogarty soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, brackenfern, salal, red huckleberry, Oregon grape, vine maple, stinging nettle, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index is 149 for Douglas fir and 169 for western hemlock. On the basis of a 50-year site curve, it is 117 for Douglas fir and 113 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 157 cubic feet per acre per year, occurring at age 60. For western hemlock it is 272 cubic feet per acre per year, occurring at age 50.

The kind of equipment that can be used and the time

of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

163—Ogarty gravelly loam, 30 to 65 percent slopes. This well drained soil is on back slopes in the foothills. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and colluvium and residuum derived dominantly from andesite and breccia. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1.5 inches thick. The surface layer is very dark grayish brown gravelly loam 4 inches thick. The upper 11 inches of the subsoil is dark brown very gravelly sandy loam. The lower 13 inches is dark yellowish brown and dark brown extremely gravelly fine

sandy loam. The substratum is brown extremely gravelly fine sandy loam 9 inches thick. Fractured andesite is at a depth of about 37 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Barneston, Blethen, and Tokul soils and Ogarty soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Ogarty soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, brackenfern, salal, red huckleberry, Oregon grape, vine maple, stinging nettle, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index is 149 for Douglas fir and 169 for western hemlock. On the basis of a 50-year site curve, it is 117 for Douglas fir and 113 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 157 cubic feet per acre per year, occurring at age 60. For western hemlock it is 272 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. A low content of moisture in the surface layer

during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

164—Ogarty-Rock outcrop complex, 45 to 90 percent slopes. This map unit is on glacially modified back slopes and ridgetops in the foothills. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 160 days.

This unit is 50 percent Ogarty gravelly loam and 40 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Barneston, Blethen, and Tokul soils, soils that are less than 20 inches deep over bedrock, stony areas, and Ogarty soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Ogarty soil is moderately deep to bedrock and is well drained. It formed in a mixture of volcanic ash and colluvium and residuum derived dominantly from andesite and breccia. Typically, the surface is covered with a mat of needles, leaves, and twigs 1.5 inches thick. The surface layer is very dark grayish brown gravelly loam 4 inches thick. The upper 11 inches of the subsoil is dark brown very gravelly sandy loam. The lower 13 inches is dark yellowish brown and dark brown extremely gravelly fine sandy loam. The substratum is brown extremely gravelly fine sandy loam 9 inches thick. Fractured andesite is at a depth of about 37 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Permeability is moderate in the Ogarty soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is andesite or breccia. It

is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, brackenfern, salal, red huckleberry, Oregongrape, vine maple, stinging nettle, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index is 149 for Douglas fir and 169 for western hemlock. On the basis of a 50-year site curve, it is 117 for Douglas fir and 113 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 157 cubic feet per acre per year, occurring at age 60. For western hemlock it is 272 cubic feet per acre per year, occurring at age 50. Yields are reduced by the Rock outcrop, which makes up about 40 percent of this unit. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, the Rock outcrop, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds

than in other areas of this unit. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. The Rock outcrop prevents the even distribution of reforestation. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Ogarty soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

165—Ohop sandy loam, 0 to 8 percent slopes. This very deep, moderately well drained soil is on river terraces and valley toe slopes. It formed in Osceola mudflow. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,200 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and moss 2 inches thick. When mixed to a depth of 7 inches, the surface layer is dark grayish brown sandy loam. The upper 9 inches of the subsoil is dark brown very gravelly loam. The lower 12 inches is brown extremely gravelly sandy loam. The substratum to a depth of 60 inches is brown extremely gravelly sandy loam. In some areas the surface layer is gravelly sandy loam. In other areas the substratum has more than 15 percent clay or has 15 to 35 percent rock fragments.

Included in this unit are small areas of Lemolo and Snoqualmie soils, organic soils, and Ohop soils that have slopes of more than 8 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is slow in the Ohop soil. Available water capacity is moderate. The effective rooting depth is limited by a perched high water table, which is at a depth of 2 to 3 feet from December through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock is the main woodland species. Among the trees of limited extent are Douglas fir, western redcedar, red alder, and black cottonwood. The common forest understory plants

are Oregongrape, salal, western swordfern, vine maple, and red huckleberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is 148. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 246 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are occasional snowpack and the muddiness caused by seasonal wetness. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and may be impassable during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. When the surface layer is removed by harvesting activities, seedlings planted in the less fertile underlying material grow poorly and lack vigor. Reforestation can be accomplished by planting western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

166—Ohop very gravelly loam, 0 to 15 percent slopes. This very deep, moderately well drained soil is on river terraces and mountain toe slopes. It formed in

recent volcanic mudflow. The native vegetation is mainly conifers and shrubs. Elevation is 1,400 to 2,400 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark grayish brown very gravelly loam 7 inches thick. The upper 9 inches of the subsoil is dark brown very gravelly loam. The lower 12 inches is brown extremely gravelly sandy loam. The substratum to a depth of 60 inches is brown extremely gravelly sandy loam. In some areas the surface layer is gravelly loam or very gravelly sandy loam. In other areas the soil has a subsoil or substratum of loamy sand, is 40 to 60 inches deep to compacted mudflow, or has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Grotto, Lemolo, and Pierking soils and Ohop soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Ohop soil. Available water capacity is low. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 2 to 3 feet from December through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent is red alder. The common forest understory plants are vine maple, western swordfern, red huckleberry, trailing blackberry, salal, longtube twinflower, and foamflower.

On the basis of a 100-year site curve, the mean site index is 160 for Douglas fir and 148 for western hemlock. On the basis of a 50-year site curve, it is 127 for Douglas fir and 108 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 170 cubic feet per acre per year, occurring at age 65. For western hemlock it is 234 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are occasional snowpack and the seasonal high water table. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is

dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in production can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir and red alder occurs periodically. Because the rooting depth is restricted by the high water table, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

167—Olomount gravelly loam, 8 to 30 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to fractured bedrock. It formed in a mixture of glacial till, volcanic ash, and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly loam 6 inches thick. The upper 8 inches of the subsoil is strong brown gravelly loam. The lower 19 inches is brownish yellow very gravelly loam. Andesite is at a depth of about 33 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Elwell, Oakes, and Philippa soils and Olomount soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Olomount soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, Pacific silver fir, and bigleaf maple. The

common forest understory plants are western brackenfern, vine maple, deer fern, salmonberry, salal, trailing blackberry, red huckleberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index is 151 for Douglas fir and 161 for western hemlock. On the basis of a 50-year site curve, it is 122 for Douglas fir and 113 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 159 cubic feet per acre per year, occurring at age 60. For western hemlock it is 256 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

168—Olomount gravelly loam, 30 to 65 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to fractured bedrock. It formed in a mixture of glacial till, volcanic ash, and colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is

800 to 1,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly loam 6 inches thick. The upper 8 inches of the subsoil is strong brown gravelly loam. The lower 19 inches is brownish yellow very gravelly loam. Andesite is at a depth of about 33 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Elwell, Oakes, and Philippa soils and Olomount soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Olomount soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, Pacific silver fir, and bigleaf maple. The common forest understory plants are western brackenfern, vine maple, deer fern, salmonberry, salal, trailing blackberry, red huckleberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index is 151 for Douglas fir and 161 for western hemlock. On the basis of a 50-year site curve, it is 122 for Douglas fir and 113 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 159 cubic feet per acre per year, occurring at age 60. For western hemlock it is 256 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. During an average year, snowpack limits the use of equipment and restricts access from January through March. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil

is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

169—Olomount-Rock outcrop complex, 45 to 90 percent slopes. This map unit is on glacially modified back slopes and ridgetops. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 140 days.

This unit is 60 percent Olomount gravelly loam and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Elwell, Oakes, and Philippa soils, soils that are less than 20 inches deep over bedrock, stony areas, and Olomount soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Olomount soil is moderately deep to fractured bedrock and is well drained. It formed in a mixture of glacial till, volcanic ash, and colluvium derived dominantly from andesite. Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly loam 6 inches thick. The upper 8 inches of the subsoil is strong brown gravelly loam. The lower 19 inches is brownish yellow very gravelly loam. Andesite is at a depth of about 33 inches. The depth to andesite ranges

from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Permeability is moderate in the Olomount soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is andesite. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, Pacific silver fir, and bigleaf maple. The common forest understory plants are western brackenfern, vine maple, deer fern, salmonberry, salal, trailing blackberry, red huckleberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index is 151 for Douglas fir and 161 for western hemlock. On the basis of a 50-year site curve, it is 122 for Douglas fir and 113 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 159 cubic feet per acre per year, occurring at age 60. For western hemlock it is 256 cubic feet per acre per year, occurring at age 50. Yields are reduced by the Rock outcrop, which makes up about 30 percent of this unit. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, the Rock outcrop, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is

moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. The Rock outcrop prevents the even distribution of reforestation. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Olomount soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

170—Oridia silt loam, 0 to 2 percent slopes. This very deep, artificially drained soil is on flood plains. It formed in alluvium. The native vegetation is mainly trees and shrubs. Elevation is 30 to 120 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface layer is brown silt loam 11 inches thick. The upper 8 inches of the underlying material is brown, mottled silt loam. The lower part to a depth of 60 inches is grayish brown, brown, gray, and light brownish gray, mottled very fine sandy loam. In some areas the surface layer is very fine sandy loam. In other areas the soil has a dark brown surface layer, is sandy loam or loam in the lower part of the underlying material, has thin strata of sand, or has 18 to 25 percent clay in the upper part of the underlying material.

Included in this unit are small areas of undrained Oridia soils, Shalcar soils in depressions that are subject to ponding, and small bodies of water. Included

areas make up about 10 percent of the total acreage.

Permeability is moderate in the Oridia soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at a depth of 1 to 3 feet from November through April. Runoff generally is very slow but can be ponded during the winter months. There is no hazard of erosion. This soil is subject to occasional, brief periods of flooding from November through April.

Most areas of this soil are drained and used as hayland, pasture, or cropland. The included undrained Oridia soils are used as woodland and as a site for homes.

In the areas used for hay and pasture, the main limitations are the high water table and the hazard of flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Grazing when the soil is wet results in compaction of the surface layer and poor tilth. In undrained areas and in areas where the drainage system is not maintained, the water table limits the choice of forage species to grasses and shallow-rooted legumes. The wetness in these areas limits the period of cutting or grazing and increases the risk of winterkill.

The main limitations in the areas used as cropland are the high water table and the hazard of flooding. This soil is well suited to most of the crops commonly grown in the survey area if adequate drainage systems are maintained. The principal crops are corn silage and small grain. Returning all crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the cropping sequence help to maintain fertility and tilth. During the growing season, the water table is artificially lowered by tile drains and field ditches to a depth of about 3 to 5 feet. Measures that maintain the drainage system are needed to ensure adequate production. Maintaining the drainage system permits fieldwork to be conducted earlier in the spring and increases the yields of perennial crops. In summer, irrigation is required for maximum production.

Red alder is the main woodland species. Among the trees of limited extent are western redcedar and black cottonwood. The common forest understory plants are salal, western brackenfern, western swordfern, spirea, rose, vine maple, and sedges.

On the basis of a 50-year site curve, the mean site index for red alder is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of red alder is about 101 cubic feet per acre per year, occurring at age 40.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground

equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available on this unit. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting red alder or western redcedar seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

In the areas used for homesite development, the main limitations are the high water table and the flooding. The wetness can be reduced by building the house on a pad and by installing drainage tile around footings in areas where a suitable outlet is available. The seasonal high water table increases the likelihood that septic tank absorption fields will fail. Installing absorption lines that are longer than normal helps to overcome this limitation.

This unit is in capability subclass IIw.

171—Orthents, avalanche chutes-Humods complex, 30 to 100 percent slopes. This map unit is on back slopes in the mountains. The native vegetation is mainly shrubs. Elevation is 1,500 to 5,000 feet. The average annual precipitation is 80 to 120 inches, and the average annual air temperature is 38 to 48 degrees F. The average frost-free period is 90 to 140 days. The mean annual soil temperature ranges from 40 to 50 degrees F.

This unit is 70 percent Orthents and 20 percent Humods. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Reggad soils, organic soils in depressions, and Orthents and Humods that have slopes of less than 30 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Orthents are moderately deep to very deep and are well drained. They formed in colluvium derived from granite. No single profile is representative of these soils. In one of the more commonly observed ones, however, the surface layer is very dark yellowish brown very cobbly sandy loam when mixed to a depth of 6 inches. The subsoil is dark yellowish brown very cobbly loamy sand 18 inches thick. The substratum is dark yellowish brown extremely stony loamy sand 6 inches thick. Granite is at a depth of about 30 inches. The depth to granite ranges from 20 to 80 inches.

Permeability is moderately rapid or rapid in the Orthents. Available water capacity is low. The effective rooting depth is 20 to more than 60 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Humods are moderately deep to very deep and are well drained. They formed in colluvium derived from granite. No single profile is representative of these soils. In one of the more commonly observed ones, however, the surface layer is black very gravelly sandy loam 5 inches thick. The upper 9 inches of the subsoil is reddish brown and dark brown extremely stony sandy loam. The lower 12 inches is dark yellowish brown extremely stony loam. Granite is at a depth of 26 inches. The depth to granite ranges from 20 to 80 inches.

Permeability is moderately rapid in the Humods. Available water capacity is low. The effective rooting depth is 20 to 80 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used as watershed.

This unit is in capability subclass VII.

172—Ovall gravelly loam, 15 to 30 percent slopes.

This well drained soil is on back slopes in the foothills. It is moderately deep to fractured bedrock. It formed in glacial drift mixed with colluvium and residuum derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is about 50 inches, and the average annual air temperature is about 51 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of needles, moss, and twigs 1 inch thick. The surface layer is dark brown gravelly loam 3 inches thick. The subsoil is brown very gravelly loam 12 inches thick. The substratum is brown very gravelly sandy loam 9 inches

thick. Andesite is at a depth of about 24 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Alderwood, Blethen, Ogarty, and Wilkeson soils and Ovall soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Ovall soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western hemlock. The common forest understory plants are salal, Oregon grape, vine maple, red huckleberry, western swordfern, western brackenfern, Pacific dogwood, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 132. On the basis of a 50-year site curve, it is 100. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 133 cubic feet per acre per year, occurring at age 70.

The kind of equipment that can be used and the time of year when it can be used normally are not restricted on this unit. The use of wheeled and tracked equipment during short periods when the soil is wet, however, causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by red

alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

173—Ovall gravelly loam, 30 to 65 percent slopes.

This well drained soil is on back slopes in the foothills. It is moderately deep to fractured bedrock. It formed in glacial drift mixed with colluvium and residuum derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is about 50 inches, and the average annual air temperature is about 51 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of needles, moss, and twigs 1 inch thick. The surface layer is dark brown gravelly loam 3 inches thick. The subsoil is brown very gravelly loam 12 inches thick. The substratum is brown very gravelly sandy loam 9 inches thick. Andesite is at a depth of about 24 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Alderwood, Blethen, Ogarty, and Wilkeson soils and Ovall soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Ovall soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western hemlock. The common forest understory plants are salal, Oregongrape, vine maple, red huckleberry, western swordfern, western brackenfern, Pacific dogwood, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 132. On the basis of a 50-year site curve, it is 100. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 133 cubic feet per acre per year, occurring at age 70.

The main limitations affecting timber harvesting are

the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

174—Pastik silt loam, 0 to 30 percent slopes. This very deep, moderately well drained soil is on terraces and escarpments. It formed in lake sediments and volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 200 to 800 feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown silt loam 6 inches thick. The subsurface layer also is dark brown silt loam 6 inches thick. The subsoil is 19 inches of dark yellowish brown and yellowish brown very fine sandy loam and silt loam. The substratum to a depth of 60 inches is olive brown

and grayish brown silt loam. In some areas the surface layer is sandy loam or loam. In other areas the substratum is silty clay.

Included in this unit are small areas of Nargar, Ogarty, Ragnar, Sulsavar, and Tokul soils and Pastik soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Pastik soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a depth of 1.5 to 2.5 feet from December through May. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used as pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used as woodland. In areas where slopes are less than 15 percent, it also is suitable for pasture and hayland.

Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar, bigleaf maple, and red alder. The common forest understory plants are western swordfern, western brackenfern, ladyfern, red huckleberry, deer fern, and vine maple.

On the basis of a 100-year site curve, the mean site index is 177 for Douglas fir and 176 for western hemlock. On the basis of a 50-year site curve, it is 132 for Douglas fir and 123 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 188 cubic feet per acre per year, occurring at age 60. For western hemlock it is 285 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IIIe.

175—Persis sandy loam, 0 to 8 percent slopes.

This very deep, well drained soil is on stream terraces. It formed in a mixture of volcanic ash and alluvium over deltaic deposits. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,600 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3.5 inches thick. When mixed to a depth of 4 inches, the surface layer is dark reddish brown sandy loam. The upper 9 inches of the subsoil is dark reddish brown loam. The lower 16 inches is dark brown and strong brown loam. The substratum to a depth of 60 inches is grayish brown sand. In some areas the surface layer is loam or loamy sand. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and 25 to 35 percent rock fragments in the substratum.

Included in this unit are small areas of Klaus, Rober, and Sauk soils and Persis soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the upper part of the Persis soil and rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are bunchberry dogwood, red huckleberry, salal, and western swordfern.

On the basis of a 100-year site curve, the mean site index for western hemlock is 162. On the basis of a 50-year site curve, it is 130. The highest average growth

rate in unmanaged, even-aged stands of western hemlock is 258 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Douglas fir have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Extra rock is needed to maintain a stable and uniform road surface. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist, a high degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

176—Persis sandy loam, windswept, 0 to 8 percent slopes. This very deep, well drained soil is on stream terraces. It formed in a mixture of volcanic ash and alluvium over deltaic deposits. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,600 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3.5 inches thick. When mixed to a depth of 4 inches, the surface layer is dark reddish brown sandy loam. The upper 9 inches of the subsoil is dark reddish brown loam. The lower 16 inches is dark brown and strong brown loam. The substratum to a depth of 60 inches is grayish brown sand. In some areas the surface layer is loam or loamy sand. In other areas the soil has 15 to 35 percent rock

fragments in the subsoil and 25 to 35 percent rock fragments in the substratum.

Included in this unit are small areas of Klaus, Rober, and Sauk soils and Persis soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the upper part of the Persis soil and rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are bunchberry dogwood, red huckleberry, salal, and western swordfern.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 138. On the basis of a 50-year site curve, it is estimated to be 100. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 214 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Douglas fir have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Extra rock is needed to maintain a stable and uniform road surface. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist, a high degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants

can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

177—Pheeney gravelly loam, 8 to 30 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to fractured bedrock. It formed in volcanic ash and in colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,500 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is very dark brown gravelly loam 11 inches thick. The upper 10 inches of the subsoil is dark brown very gravelly loam. The lower 13 inches is dark yellowish brown extremely gravelly loam. Fractured andesite is at a depth of about 34 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Littlejohn, Pitcher, and Zynbar soils and Pheeney soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pheeney soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are western brackenfern, vine maple, violet, Oregon grape, salal, western swordfern, red huckleberry, and Oregon oxalis.

On the basis of a 100-year site curve, the mean site index is 135 for Douglas fir and 121 for western hemlock. On the basis of a 50-year site curve, it is 101 for Douglas fir and 85 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 138 cubic feet per acre per year, occurring at age 70. For western hemlock it is 182 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of

wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

178—Pheeney gravelly loam, 30 to 65 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to fractured bedrock. It formed in volcanic ash and in colluvium derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,500 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is very dark brown gravelly loam 11 inches thick. The upper 10 inches of the subsoil is dark brown very gravelly loam. The lower 13 inches is dark yellowish brown extremely gravelly loam. Fractured andesite is at a depth of about 34 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other

areas the soil has 15 to 35 percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Littlejohn, Pitcher, and Zynbar soils and Pheeney soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pheeney soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are western brackenfern, vine maple, violet, Oregongrape, salal, western swordfern, red huckleberry, and Oregon oxalis.

On the basis of a 100-year site curve, the mean site index is 135 for Douglas fir and 121 for western hemlock. On the basis of a 50-year site curve, it is 101 for Douglas fir and 85 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 138 cubic feet per acre per year, occurring at age 70. For western hemlock it is 182 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. During an average year, snowpack limits the use of equipment and restricts access from January through March. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished

by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

179—Pheeney gravelly silt loam, tuff substratum, 8 to 30 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to fractured bedrock. It formed in volcanic ash and in colluvium derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 1,500 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4.5 inches thick. The upper 4 inches of the surface layer is dark brown gravelly silt loam. The lower 8 inches is dark brown gravelly loam. The subsoil is dark yellowish brown extremely gravelly loam 22 inches thick. Weathered tuff is at a depth of about 34 inches. The depth to breccia or tuff ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Littlejohn, Pitcher, and Zynbar soils and Pheeney soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pheeney soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are western brackenfern, vine maple, violet, Oregongrape, salal, western swordfern, red huckleberry, and Oregon oxalis.

On the basis of a 100-year site curve, the mean site index is 135 for Douglas fir and 121 for western

hemlock. On the basis of a 50-year site curve, it is 101 for Douglas fir and 85 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 138 cubic feet per acre per year, occurring at age 70. For western hemlock it is 182 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

180—Pheeneey gravelly silt loam, tuff substratum, 30 to 65 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to fractured bedrock. It formed in volcanic ash and in colluvium derived dominantly from breccia. The native

vegetation is mainly conifers and shrubs. Elevation is 1,500 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4.5 inches thick. The upper 4 inches of the surface layer is dark brown gravelly silt loam. The lower 8 inches is dark brown gravelly loam. The subsoil is dark yellowish brown extremely gravelly loam 22 inches thick. Weathered tuff is at a depth of about 34 inches. The depth to breccia or tuff ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Pitcher, Littlejohn, and Zynbar soils and Pheeneey soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pheeneey soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are western brackenfern, vine maple, violet, Oregon grape, salal, western swordfern, red huckleberry, and Oregon oxalis.

On the basis of a 100-year site curve, the mean site index is 135 for Douglas fir and 121 for western hemlock. On the basis of a 50-year site curve, it is 101 for Douglas fir and 85 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 138 cubic feet per acre per year, occurring at age 70. For western hemlock it is 182 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. During an average year, snowpack limits the use of equipment and restricts access from January through March. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill

slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

181—Pheeneey-Rock outcrop complex, 30 to 90 percent slopes. This map unit is on glacially modified back slopes and ridgetops. The native vegetation is mainly conifers and shrubs. Elevation is 1,500 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 170 days.

This unit is 50 percent Pheeneey gravelly loam and 40 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Littlejohn, Pitcher, and Zynbar soils, soils that are less than 20 inches deep over bedrock, stony areas, and Pheeneey soils that have slopes of less than 30 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Pheeneey soil is moderately deep to fractured bedrock and is well drained. It formed in volcanic ash

and in colluvium derived dominantly from andesite. Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is very dark brown gravelly loam 11 inches thick. The upper 10 inches of the subsoil is dark brown very gravelly loam. The lower 13 inches is dark yellowish brown extremely gravelly loam. Fractured andesite is at a depth of about 34 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or gravelly silt loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock.

Permeability is moderate in the Pheeneey soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is andesite. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are western brackenfern, vine maple, violet, Oregon grape, salal, western swordfern, red huckleberry, and Oregon oxalis.

On the basis of a 100-year site curve, the mean site index is 135 for Douglas fir and 121 for western hemlock. On the basis of a 50-year site curve, it is 101 for Douglas fir and 85 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 138 cubic feet per acre per year, occurring at age 70. For western hemlock it is 182 cubic feet per acre per year, occurring at age 50. Yields are reduced by the Rock outcrop, which makes up about 40 percent of this unit. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, occasional snowpack, the Rock outcrop, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. The Rock outcrop prevents the even distribution of reforestation. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Pheeney soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

182—Philippa sandy loam, 0 to 30 percent slopes.

This moderately well drained soil is in cirques and on lateral moraines in the mountains. It is moderately deep to ortstein. It formed in a mixture of volcanic ash, colluvium, and ablation till over dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of

needles and twigs 2 inches thick. When mixed to a depth of 4 inches, the surface layer is dark brown sandy loam. The upper 14 inches of the subsoil is variegated dark reddish brown, strong brown, and dark brown gravelly silt loam. The lower 10 inches is dark yellowish brown very gravelly sandy loam. Dark grayish brown ortstein that crushes to extremely gravelly loamy sand is at a depth of about 28 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loam. In other areas the soil has less than 35 percent rock fragments in the subsoil, is 40 to 60 inches deep to dense glacial till, or has a less developed subsoil.

Included in this unit are small areas of Kaleetan, Marblemount, Melakwa, and Teneriffe soils, soils that are less than 20 inches deep to ortstein, and Philippa soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Philippa soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from December through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, red alder, and western redcedar. The common forest understory plants are western swordfern, deer fern, red huckleberry, salmonberry, vine maple, devilsclub, and salal.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 144. On the basis of a 50-year site curve, it is estimated to be 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 150 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is

wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the dense glacial till, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

183—Philippa sandy loam, 30 to 65 percent slopes. This moderately deep, moderately well drained soil is in cirques and on lateral moraines in the mountains. It formed in a mixture of volcanic ash, colluvium, and ablation till over dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles and twigs 2 inches thick. When mixed to a depth of 4 inches, the surface layer is dark brown sandy loam. The upper 5 inches of the subsoil is variegated dark reddish brown and strong brown gravelly silt loam. The next 9 inches is dark brown gravelly silt loam. The lower 10 inches is dark yellowish brown very gravelly sandy loam. Dark grayish brown ortstein that crushes to extremely gravelly loamy sand is at a depth of about 28 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loam. In other areas the soil has less than 35 percent rock fragments in the subsoil, is 40 to 60 inches deep to dense glacial till, or has a less developed subsoil.

Included in this unit are small areas of Kaleetan, Marblemount, Melakwa, and Teneriffe soils, soils that are less than 20 inches deep to ortstein, and Philippa soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15

percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the upper part of the Philippa soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from December through March. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, red alder, and western redcedar. The common forest understory plants are western swordfern, deer fern, red huckleberry, salmonberry, vine maple, devilsclub, and salal.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 144. On the basis of a 50-year site curve, it is estimated to be 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 150 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are occasional snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural

reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the dense glacial till, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

184—Pierking gravelly sandy loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on river terraces. It formed in stream alluvium and mudflow deposits. The native vegetation is mainly conifers, hardwoods, and shrubs. Elevation is 1,200 to 2,000 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of leaves and needles 4 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown gravelly sandy loam. The subsoil is dark brown and very dark gray very gravelly sandy loam 28 inches thick. The substratum to a depth of 60 inches is dark bluish gray very gravelly sandy loam. In some areas the surface layer is loam, sandy loam, gravelly loam, or gravelly loamy sand. In other areas the substratum has sandy and loamy strata.

Included in this unit are small areas of Greenwater, Lemolo, Pilchuck, and Snoqualmie soils and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Pierking soil. Available water capacity is low. The effective rooting depth is limited by an apparent high water table, which is at a depth of 0.5 to 1.0 foot from November through March. Runoff is very slow, and there is no hazard of erosion. This soil is subject to rare flooding.

This unit is used as woodland. Western hemlock and red alder are the main woodland species. Among the trees of limited extent are western redcedar, Douglas fir, black cottonwood, grand fir, and Sitka spruce. The common forest understory plants are western swordfern, vine maple, Oregon grape, red huckleberry, devilsclub, skunk cabbage, ladyfern, montia, trailing blackberry, Oregon oxalis, salmonberry, horsetail, and elk sedge.

On the basis of a 100-year site curve, the mean site index is 139 for western hemlock. On the basis of a 50-year site curve, it is 102 for western hemlock and is estimated to be 100 for red alder. The highest average growth rate in unmanaged, even-aged stands of

western hemlock is 216 cubic feet per acre per year, occurring at age 60. For red alder it is about 118 cubic feet per acre per year, occurring at age 40.

The main limitations affecting timber harvesting are occasional snowpack and the muddiness caused by seasonal wetness. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and may be impassable during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. When the surface layer is removed by harvesting activities, seedlings planted in the less fertile underlying material grow poorly and lack vigor. Reforestation can be accomplished by planting western hemlock, western redcedar, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock, red alder, and western redcedar occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVw.

185—Pierking-Borohemists complex, 0 to 5 percent slopes. This map unit is on river terraces. The native vegetation is mainly conifers and shrubs. Elevation is 1,400 to 2,000 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 120 days.

This unit is 70 percent Pierking gravelly sandy loam, 0 to 5 percent slopes, and 20 percent Borohemists, 0 to

1 percent slopes. The Borohemists are in depressions on the terraces. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Greenwater, Lemolo, Pilchuck, and Snoqualmie soils. Included areas make up about 10 percent of the total acreage.

The Pierking soil is very deep and somewhat poorly drained. It formed in stream alluvium and mudflow deposits. Typically, the surface is covered with a mat of leaves and needles 4 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown gravelly sandy loam. The subsoil is dark brown and very dark gray very gravelly sandy loam 28 inches thick. The substratum to a depth of 60 inches is dark bluish gray very gravelly sandy loam. In some areas the surface layer is loam, sandy loam, gravelly loam, or gravelly loamy sand. In other areas the substratum has sandy and loamy strata.

Permeability is moderately slow in the Pierking soil. Available water capacity is low. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 0.5 to 1.0 foot from November through March. Runoff is very slow and there is no hazard of erosion. This soil is subject to rare flooding.

The Borohemists are very deep and very poorly drained. They formed in partially decomposed herbaceous plant material over decomposed woody material having varying amounts of mineral material derived from alluvium or mudflow deposits. No single profile is representative of these soils. In one of the more commonly observed ones, however, the surface layer is very dark brown mucky peat about 4 inches thick. The upper 26 inches of the underlying material is very dark grayish brown hemic material. The next 4 inches is very dark brown sandy loam. The lower part to a depth of 60 inches is dark reddish brown hemic material. The depth to mineral soil material ranges from 20 to more than 60 inches. After rubbing, the overall content of fiber ranges from 20 to 30 percent, although individual layers can have as much as 50 percent. Reaction is extremely acid or very strongly acid.

Permeability is moderate in the Borohemists. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at or above the surface from October through June. Runoff is ponded, and there is no hazard of erosion. These soils are subject to rare flooding.

The Pierking soil is used as woodland. The Borohemists are used for wildlife habitat. They are poorly suited to timber production.

Western hemlock and red alder are the main woodland species on the Pierking soil. Among the trees

of limited extent are western redcedar, Douglas fir, black cottonwood, grand fir, and Sitka spruce. The common forest understory plants are western swordfern, vine maple, Oregon grape, red huckleberry, devil's club, skunk cabbage, ladyfern, montia, trailing blackberry, Oregon oxalis, salmonberry, horsetail, and elk sedge. The native vegetation on the Borohemists consists mainly of hardhack, cattail, rushes, and sedges. It also includes some Sitka spruce, western redcedar, western hemlock, and red alder. Ponding on these soils may result in the mortality of coniferous trees.

On the basis of a 100-year site curve, the mean site index on the Pierking soil is 139 for western hemlock. On the basis of a 50-year site curve, it is 102 for western hemlock and is estimated to be 100 for red alder. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 216 cubic feet per acre per year, occurring at age 60. For red alder it is about 118 cubic feet per acre per year, occurring at age 40.

The main limitations affecting timber harvesting are occasional snowpack, the muddiness caused by seasonal wetness, and ponding in scattered areas of the Borohemists. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soils are wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soils. Unsurfaced roads are soft when wet and may be impassable during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soils are moist, a moderate degree of puddling when the soils are wet, and a moderate degree of soil displacement when the soils are dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production on the Pierking soil. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. When the surface layer is removed by harvesting activities, seedlings planted in the less fertile underlying material grow poorly and lack vigor. Reforestation can be accomplished by planting western hemlock, western redcedar, or red alder seedlings. If seed trees are

available, natural reforestation of cutover areas by western hemlock, red alder, and western redcedar occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soils are wet and winds are strong.

The Pierking soil is in capability subclass IVw. The Borohemists are in capability subclass Vw.

186—Pierking-Mowich complex, 2 to 15 percent slopes. This map unit is on back slopes in river valleys. The native vegetation is mainly conifers and shrubs. Elevation is 1,400 to 2,000 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 120 days.

This unit is 60 percent Pierking gravelly sandy loam, 2 to 5 percent slopes, and 30 percent Mowich silt loam, 2 to 15 percent slopes. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Lemolo and Norma soils, Borohemists, and Mowich soils that have slopes of more than 15 percent. Included areas make up about 10 percent of the total acreage.

The Pierking soil is very deep and somewhat poorly drained. It formed in stream alluvium and mudflow deposits. Typically, the surface is covered with a mat of leaves and needles 4 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown gravelly sandy loam. The subsoil is dark brown and very dark gray very gravelly sandy loam 28 inches thick. The substratum to a depth of 60 inches is dark bluish gray very gravelly sandy loam. In some areas the surface layer is loam, sandy loam, gravelly loam, or gravelly loamy sand. In other areas the substratum has sandy and loamy strata.

Permeability is moderately slow in the Pierking soil. Available water capacity is low. The effective rooting depth is limited by an apparent high water table, which is at a depth of 0.5 to 1.0 foot from November through March. Runoff is very slow, and there is no hazard of erosion.

The Mowich soil is very deep and somewhat poorly drained. It formed in volcanic ash over glaciolacustrine sediments. Typically, the surface is covered with a mat of organic material 8 inches thick. The surface layer is dark brown silt loam 7 inches thick. The upper 3 inches of the subsoil is strong brown silt loam. The lower 16

inches is dark yellowish brown, mottled silt loam. The substratum to a depth of 60 inches is light brownish gray, mottled silty clay. Depth to the clayey substratum ranges from 20 to 35 inches. In some areas the surface layer is loam. In other areas the substratum has 30 to 45 percent clay or is at a depth of 10 to 20 inches.

Permeability is slow in the Mowich soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 1 to 2 feet from November through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock, Douglas fir, and red alder are the main woodland species. Among the trees of limited extent are western redcedar, black cottonwood, grand fir, and Sitka spruce. The common forest understory plants are western swordfern, salal, vine maple, Oregon grape, red huckleberry, devil's club, deer fern, skunk cabbage, ladyfern, montia, trailing blackberry, Oregon oxalis, salmonberry, horsetail, and elk sedge.

On the basis of a 100-year site curve, the mean site index on the Pierking soil is 139 for western hemlock. On the basis of a 50-year site curve, it is 102 for western hemlock and is estimated to be 100 for red alder. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 216 cubic feet per acre per year, occurring at age 60. For red alder it is about 118 cubic feet per acre per year, occurring at age 40.

On the basis of a 100-year site curve, the mean site index on the Mowich soil is 156 for Douglas fir. On the basis of a 50-year site curve, it is 121. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 165 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are occasional snowpack and the muddiness caused by seasonal wetness. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soils are wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soils. Unsurfaced roads are soft when wet and may be impassable during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate to high degree of soil compaction when the soils are moist, a moderate to high degree of puddling when the soils are wet, and a moderate degree of soil displacement when the soils are dry. Carefully laying out roads and skid trails, properly timing their use, and

using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. When the surface layer is removed by harvesting activities, seedlings planted in the less fertile underlying material grow poorly and lack vigor. Reforestation can be accomplished by planting western hemlock, western redcedar, or red alder on the Pierking soil and Douglas fir on the Mowich soil. If seed trees are available, natural reforestation of cutover areas by western hemlock, red alder, and western redcedar occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are occasionally subject to windthrow when the soils are wet and winds are strong.

This unit is in capability subclass IVw.

187—Pilchuck loamy fine sand, 0 to 3 percent slopes. This very deep, somewhat excessively drained soil is on flood plains. It formed in sandy alluvium. The native vegetation is mainly trees and shrubs. Elevation is 200 to 800 feet. The average annual precipitation is about 50 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 180 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 0.5 inch thick. The surface layer is very dark grayish brown loamy fine sand 9 inches thick. The upper 46 inches of the underlying material is very dark grayish brown and very dark gray loamy fine sand and fine sand. The lower part to a depth of 60 inches is black very gravelly sand. In some areas the surface layer is loamy sand, sand, or sandy loam. In other areas the soil is stratified with fine sandy loam or is 30 to 40 inches deep to very gravelly sand.

Included in this unit are small areas of Edgewick and Snoqualmie soils, organic or poorly drained mineral soils in depressions, Riverwash, and soils that are similar to the Pilchuck soil but have a seasonal high water at a depth of 48 to 60 inches. Included areas make up about 10 percent of the total acreage.

Permeability is rapid in the Pilchuck soil. Available water capacity is moderate. The effective rooting depth is limited by an apparent high water table, which is at a

depth of 2 to 4 feet from November through April. Runoff is very slow, and the hazard of water erosion is severe because of the susceptibility to flooding and channeling. This soil is subject to occasional, brief periods of flooding from November through April. The flooding occurs during periods of snowmelt and rainfall.

This unit is used mainly as woodland. It also is used as pasture and grazable woodland. Proper stocking rates, pasture rotation, and restricted grazing during short wet periods help to keep the pasture in good condition and help to control runoff and erosion. Because of inherently low fertility, this soil requires more fertilizer than most other soils in the survey area if it is to produce similar yields. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, western redcedar, bigleaf maple, and black cottonwood. The common forest understory plants are vine maple, western swordfern, salmonberry, common snowberry, false Solomons seal, and western brackenfern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 152. On the basis of a 50-year site curve, it is estimated to be 114. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 161 cubic feet per acre per year, occurring at age 60.

The main hazard affecting timber harvesting is the flooding. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and establishment are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. The seedling survival rate may be low where flooding occurs. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder, bigleaf maple, and black cottonwood occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing

vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVw.

188—Pitcher sandy loam, 8 to 30 percent slopes.

This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash over colluvium and residuum derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1.5 inches thick. The surface layer is dark brown sandy loam 8 inches thick. The upper 8 inches of the subsoil is dark brown gravelly sandy loam. The next 13 inches is brown very gravelly loam. The lower part to a depth of 60 inches is brown and yellowish brown very gravelly loam. In some areas the surface layer is loam, gravelly loam, or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Kaleetan, Littlejohn, and Olomount soils and Pitcher soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pitcher soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir, Pacific silver fir, and red alder. The common forest understory plants are western swordfern, vine maple, red huckleberry, salal, trailing blackberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 145. On the basis of a 50-year site curve, it is estimated to be 112. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 152 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced

roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

189—Pitcher sandy loam, 30 to 65 percent slopes.

This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash over colluvium and residuum derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1.5 inches thick. The surface layer is dark brown sandy loam 8 inches thick. The upper 8 inches of the subsoil is dark brown gravelly sandy loam. The next 13 inches is brown very gravelly loam. The lower part to a depth of 60 inches is brown and yellowish brown very gravelly loam. In some areas the surface layer is loam, gravelly loam, or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Kaleetan, Littlejohn, and Olomount soils and Pitcher soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pitcher soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir, Pacific silver fir, and red alder. The common forest understory plants are western swordfern, vine maple, red huckleberry, salal, trailing blackberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145. On the basis of a 50-year site curve, it is 112. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 152 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

190—Pitcher sandy loam, windswept, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash over colluvium and residuum derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1.5 inches thick. The surface layer is dark brown sandy loam 8 inches thick. The upper 8 inches of the subsoil is dark brown gravelly sandy loam. The next 13 inches is brown very gravelly loam. The lower part to a depth of 60 inches is brown and yellowish brown very gravelly loam. In some areas the surface layer is loam, gravelly loam, or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Kaleetan, Littlejohn, and Olomount soils and Pitcher soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pitcher soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir, Pacific silver fir, and red alder. The common forest understory plants are western swordfern, vine maple, red huckleberry, salal, trailing blackberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 133. On the basis of a 50-year site curve, it is estimated to be 100. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 134 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of western hemlock have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally

are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

191—Pitcher sandy loam, tuff substratum, 8 to 30 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash over colluvium and residuum derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. The surface layer is dark brown sandy loam 7 inches thick. The upper 6 inches of the subsoil is dark yellowish brown gravelly sandy loam. The lower 16 inches is dark brown very gravelly sandy loam and dark yellowish brown very gravelly loam. The substratum to a depth of 60 inches is brown extremely gravelly sandy loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is loam, gravelly loam, or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Kaleetan, Littlejohn, and Olomount soils and Pitcher soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pitcher soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir, Pacific silver fir, and red alder. The common forest understory plants are western swordfern, vine maple, red huckleberry, salal, trailing blackberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 145. On the basis of a 50-year site curve, it is estimated to be 112. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 152 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover

areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

192—Pitcher sandy loam, tuff substratum, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash over colluvium and residuum derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. The surface layer is dark brown sandy loam 7 inches thick. The upper 6 inches of the subsoil is dark yellowish brown gravelly sandy loam. The lower 16 inches is brown very gravelly sandy loam and dark yellowish brown very gravelly loam. The substratum to a depth of 60 inches is brown extremely gravelly sandy loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is loam, gravelly loam, or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Kaleetan, Littlejohn, and Olomount soils and Pitcher soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pitcher soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir, Pacific silver fir, and red alder. The common forest understory plants are western swordfern, vine maple, red huckleberry, salal, trailing blackberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145. On the basis of a 50-year site curve, it is 112. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 151 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are

the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

193—Pitcher sandy loam, tuff substratum, windswept, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash over colluvium and residuum derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. The surface

layer is dark brown sandy loam 7 inches thick. The upper 6 inches of the subsoil is dark yellowish brown gravelly sandy loam. The lower 16 inches is brown very gravelly sandy loam and dark yellowish brown very gravelly loam. The substratum to a depth of 60 inches is brown extremely gravelly sandy loam. In some areas the surface layer is loam, gravelly loam, or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil and substratum or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Kaleetan, Littlejohn, and Olomount soils and Pitcher soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Pitcher soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir, Pacific silver fir, and red alder. The common forest understory plants are western swordfern, vine maple, red huckleberry, salal, trailing blackberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 133. On the basis of a 50-year site curve, it is estimated to be 100. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 134 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of western hemlock have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when

the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

194—Pitcher-Rock outcrop complex, 30 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

This unit is 60 percent Pitcher sandy loam and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Kaleetan, Littlejohn, and Olomount soils, stony areas, and Pitcher soils that have slopes of less than 30 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Pitcher soil is very deep and well drained. It formed in volcanic ash over colluvium and residuum derived dominantly from extrusive igneous rocks. Typically, the surface is covered with a mat of needles, leaves, and twigs 1.5 inches thick. The surface layer is dark brown sandy loam 8 inches thick. The upper 8 inches of the subsoil is dark brown gravelly sandy loam. The next 13 inches is brown very gravelly loam. The lower part to a depth of 60 inches is brown and yellowish brown very gravelly loam. In some areas the surface layer is loam, gravelly loam, or gravelly sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the subsoil or is 40 to 60 inches deep over bedrock.

Permeability is moderate in the Pitcher soil. Available

water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Typically, the Rock outcrop is extrusive igneous rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are noble fir, Pacific silver fir, and red alder. The common forest understory plants are western swordfern, vine maple, red huckleberry, salal, trailing blackberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145. On the basis of a 50-year site curve, it is 112. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 151 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. Yields are reduced by the Rock outcrop, which makes up about 30 percent of this unit.

The main limitations affecting timber harvesting are the slope, the Rock outcrop, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling

and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs occasionally. The Rock outcrop prevents the even distribution of reforestation. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

The Pitcher soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

195—Pits. This map unit is on outwash terraces and mountain foothills. It consists of areas excavated for gravel, sand, and hard rock. Areas are irregular in shape and are 5 to 90 acres in size.

Included in this unit are small areas of soils that have not been excavated, partially filled dump sites, and small ponds in areas where material has been excavated below the water table. Included areas make up about 10 percent of the total acreage.

A seasonal high water table fluctuates between the surface and a depth of more than 60 inches from November through April. Permeability, the effective rooting depth, available water capacity, surface runoff, and the hazard of erosion vary, depending on the amount of surface disturbance. Runoff is ponded to very rapid. In some areas there is no hazard of water erosion. In other areas the hazard is slight to severe.

This unit is used mainly as a source of gravel, sand, and rock. It also is used for wildlife habitat. It varies widely in texture and depth to bedrock. Onsite evaluation is needed to determine suitable uses. Reclamation is needed for most potential uses.

This unit is in capability subclass VIIIs.

196—Playco loamy sand, 8 to 30 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice mixed with colluvium derived from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 3,600 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of

needles, twigs, bark, and moss 1 inch thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown loamy sand. The upper 4 inches of the subsoil is dark brown sandy loam. The lower 26 inches is dark brown very gravelly loam and dark yellowish brown extremely gravelly loam. The substratum to a depth of 60 inches is yellowish brown very gravelly loam. In some areas the surface layer is sandy loam or gravelly sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Nagrom and Nimue soils and Playco soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Playco soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Douglas fir. The common forest understory plants are montia, trillium, devilsclub, huckleberry, Oregongrape, Pacific yew, salal, and western swordfern.

On the basis of a 100-year site curve, the mean site index for western hemlock is 127. On the basis of a 50-year site curve, it is 89. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 194 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate

reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIe.

197—Playco loamy sand, 30 to 65 percent slopes.

This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice mixed with colluvium derived from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 3,600 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 1 inch thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown loamy sand. The upper 4 inches of the subsoil is dark brown sandy loam. The lower 26 inches is dark brown very gravelly loam and dark yellowish brown extremely gravelly loam. The substratum to a depth of 60 inches is yellowish brown very gravelly loam. In some areas the surface layer is sandy loam or gravelly sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Nagrom and Nimue soils and Playco soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Playco soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Douglas fir. The common forest understory plants are montia, trillium, devilsclub, huckleberry, Oregongrape, Pacific yew, salal, and western swordfern.

On the basis of a 100-year site curve, the mean site index for western hemlock is 127. On the basis of a 50-year site curve, it is 89. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 194 cubic feet per acre per year, occurring

at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIIe.

198—Playco loamy sand, 65 to 90 percent slopes.

This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice mixed with colluvium derived from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 3,600 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 1 inch thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown loamy sand. The upper 4 inches of the subsoil is dark brown sandy loam. The lower 26 inches

is dark brown very gravelly loam and dark yellowish brown extremely gravelly loam. The substratum to a depth of 60 inches is yellowish brown very gravelly loam. In some areas the surface layer is sandy loam or gravelly sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Included in this unit are small areas of Nagrom and Nimue soils and Playco soils that have slopes of less than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Playco soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Douglas fir. The common forest understory plants are montia, trillium, devilsclub, huckleberry, Oregongrape, Pacific yew, salal, and western swordfern.

On the basis of a 100-year site curve, the mean site index for western hemlock is 127. On the basis of a 50-year site curve, it is 89. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 194 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling

and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIIe.

199—Playco very gravelly loamy sand, tuff substratum, 8 to 30 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice mixed with colluvium derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 3,600 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, twigs, and bark 2 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown very gravelly loamy sand. The upper 10 inches of the subsoil is dark yellowish brown very gravelly loamy sand. The lower 33 inches is dark yellowish brown extremely gravelly sandy loam. The substratum to a depth of 60 inches is olive brown extremely gravelly sandy loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is gravelly sandy loam, gravelly loamy sand, or very gravelly sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Nagrom and Nimue soils and Playco soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Playco soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Douglas fir. The common forest understory plants are montia,

trillium, devilsclub, huckleberry, Oregongrape, Pacific yew, salal, and western swordfern.

On the basis of a 100-year site curve, the mean site index for western hemlock is 113. On the basis of a 50-year site curve, it is 79. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 166 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIe.

200—Playco very gravelly loamy sand, tuff substratum, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice mixed with colluvium

derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 3,600 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, twigs, and bark 2 inches thick. When mixed to a depth of 7 inches, the surface layer is dark reddish brown very gravelly loamy sand. The upper 10 inches of the subsoil is dark yellowish brown very gravelly loamy sand. The lower 33 inches is dark yellowish brown extremely gravelly sandy loam. The substratum to a depth of 60 inches is olive brown extremely gravelly sandy loam. The depth to tuff or breccia commonly ranges from 5 to 10 feet. In some areas the surface layer is gravelly sandy loam, gravelly loamy sand, or very gravelly sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Nagrom and Nimue soils and Playco soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Playco soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Douglas fir. The common forest understory plants are montia, trillium, devilsclub, huckleberry, Oregongrape, Pacific yew, salal, and western swordfern.

On the basis of a 100-year site curve, the mean site index for western hemlock is 113. On the basis of a 50-year site curve, it is 79. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 166 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for

road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIIe.

201—Playco-Rock outcrop complex, 30 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 3,600 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

This unit is 60 percent Playco loamy sand and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Nagrom, Nimue, and Reggad soils, talus, soils that are 10 to 20 inches deep over bedrock, and Playco soils that have slopes of less than 30 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Playco soil is very deep and well drained. It formed in volcanic ash and pumice mixed with colluvium derived dominantly from extrusive igneous rocks. Typically, the surface is covered with a mat of needles, twigs, and bark 2 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown loamy sand. The upper 4 inches of the subsoil is dark

reddish brown sandy loam. The lower 26 inches is dark brown very gravelly loam and dark yellowish brown extremely gravelly sandy loam. The substratum to a depth of 60 inches is yellowish brown very gravelly loam. In some areas the surface layer is gravelly sandy loam, gravelly loamy sand, or very gravelly sandy loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep over bedrock.

Permeability is moderate in the Playco soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is extrusive igneous rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and Douglas fir. The common forest understory plants are montia, trillium, devilsclub, huckleberry, Oregongrape, Pacific yew, salal, and western swordfern.

On the basis of a 100-year site curve, the mean site index for western hemlock is 127. On the basis of a 50-year site curve, it is 89. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 194 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 30 percent of this unit.

The main limitations affecting timber harvesting are snowpack, the Rock outcrop, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation.

The Playco soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

202—Puget silty clay loam, 0 to 2 percent slopes.

This very deep, artificially drained soil is on flood plains. It formed in alluvium. The native vegetation is mainly trees and shrubs. Elevation is 25 to 500 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

When mixed to a depth of 7 inches, the surface layer is dark grayish brown silty clay loam. The upper 33 inches of the underlying material is grayish brown, mottled silty clay loam. The next 5 inches is greenish gray, mottled silty clay loam. The lower part to a depth of 60 inches is gray, mottled silty clay. In some areas the surface layer is silt loam. In other areas the soil has a dark brown surface layer. In places the underlying material is sandy loam or loamy sand, has 10 to 18 percent clay, or has thin strata of sandy or organic material.

Included in this unit are small areas of undrained Puget soils, Shalcar soils in depressions that are subject to ponding, and small bodies of water. Included areas make up about 10 percent of the total acreage.

Permeability is moderately slow in the Puget soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at a depth of 1 to 3 feet from November through May.

Runoff generally is very slow, but it can be ponded during the winter months. There is no hazard of erosion. This soil is subject to occasional, brief periods of flooding from November through April.

This unit is used mainly as cropland, hayland, or pasture. The included undrained Puget soils are used as woodland.

In the areas used for hay and pasture, the main limitations are the high water table, the hazard of flooding, and the moderately slow permeability. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Grazing when the soil is wet results in compaction of the surface layer and poor tilth. In undrained areas and in areas where the drainage system is not maintained, the water table limits the choice of forage species to grasses and shallow-rooted legumes. The wetness in these areas limits the period of cutting or grazing and increases the risk of winterkill.

The main limitations in the areas used as cropland are the high water table, the hazard of flooding, and the moderately slow permeability. This soil is well suited to most of the crops commonly grown in the survey area if adequate drainage systems are maintained. The principal crops are corn silage and small grain. Returning all crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the cropping sequence help to maintain fertility and tilth. During the growing season, the water table is artificially lowered by tile drains and field ditches to a depth of about 3 to 5 feet. Measures that maintain the drainage system are needed to ensure adequate production. Maintaining the drainage system permits fieldwork to be conducted earlier in the spring and increases the yields of perennial crops. In summer, irrigation is required for maximum production.

Red alder is the main woodland species. Among the trees of limited extent are black cottonwood and western redcedar. The common forest understory plants are salal, western brackenfern, western swordfern, spirea, rose, vine maple, and sedges.

On the basis of a 50-year site curve, the mean site index for red alder is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of red alder is about 101 cubic feet per acre per year, occurring at age 40.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road

construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting red alder or western redcedar seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong. The seedling survival rate may be low where flooding occurs.

In the areas used for homesite development, the main limitations are the high water table and the hazard of flooding. The wetness can be reduced by building the house on a pad and by installing drainage tile around footings in areas where a suitable outlet is available. The moderately slow permeability and the high water table increase the likelihood that septic tank absorption fields will fail. Installing absorption lines that are longer than normal helps to overcome these limitations.

This unit is in capability subclass IIw.

203—Ragnar loam, 6 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,000 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 180 days.

Typically, the surface layer is covered with a mat of undecomposed needles, leaves, and twigs 1 inch thick. The surface layer is dark brown loam 13 inches thick. The subsoil is dark yellowish brown sandy loam 11 inches thick. The substratum to a depth of 60 inches is light olive brown loamy sand. Depth to the substratum ranges from 20 to 30 inches. In some areas the surface layer is sandy loam. In other areas the substratum has 15 to 40 percent pebbles. In places the combined

thickness of the surface layer and subsoil is 8 to 20 inches.

Included in this unit are small areas of Barneston and Lynnwood soils, Norma soils in depressions, and Ragnar soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the Ragnar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used for hay and pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used as hayland, pasture, or woodland. In the areas used for hay and pasture, the main limitation is the slope. In summer, irrigation is required for maximum production.

Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder and western redcedar. The common forest understory plants are western swordfern, western brackenfern, Oregon grape, salal, huckleberry, trailing blackberry, and evergreen huckleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 168. On the basis of a 50-year site curve, it is 126. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 179 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist, a high degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. A low content of moisture in the surface layer

during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

204—Ragnar loam, 15 to 30 percent slopes. This very deep, well drained soil is on terraces. It formed in glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 1,000 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 180 days.

Typically, the surface layer is covered with a mat of undecomposed needles, leaves, and twigs 1 inch thick. The surface layer is dark brown loam 13 inches thick. The subsoil is dark yellowish brown sandy loam 11 inches thick. The substratum to a depth of 60 inches is light olive brown loamy sand. Depth to the substratum ranges from 20 to 30 inches. In some areas the surface layer is sandy loam. In other areas the substratum has 15 to 40 percent pebbles. In places the combined thickness of the surface layer and subsoil is 8 to 20 inches.

Included in this unit are small areas of Barneston and Lynnwood soils, Norma soils in depressions, and Ragnar soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately rapid in the Ragnar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder and western redcedar. The common forest understory plants are western swordfern, western brackenfern, Oregon grape, salal, huckleberry, trailing blackberry, and evergreen huckleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 168. On the basis of a 50-year site curve, it is 126. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 179 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet

causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist, a high degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

205—Ragnar-Lynnwood complex, 2 to 15 percent slopes. This map unit is on outwash terraces. The native vegetation is mainly conifers and shrubs. Elevation is 300 to 600 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 180 days.

This unit is 45 percent Ragnar loam and 45 percent Lynnwood loamy fine sand. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Barneston soils, Norma soils in depressions, and Ragnar and Lynnwood soils that have slopes of more than 15 percent or less than 2 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Ragnar soil is very deep and well drained. It formed in glacial outwash. Typically, the surface layer is covered with a mat of undecomposed needles, leaves, and twigs 1 inch thick. The surface layer is dark brown loam 13 inches thick. The subsoil is dark yellowish brown sandy loam 11 inches thick. The substratum to a

depth of 60 inches is light olive brown loamy sand. Depth to the substratum ranges from 20 to 30 inches. In some areas the surface layer is sandy loam. In other areas the substratum has 15 to 40 percent pebbles. In places the combined thickness of the surface layer and subsoil is 8 to 20 inches.

Permeability is moderately rapid in the Ragnar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used for hay and pasture, however, runoff is medium and the hazard of erosion is moderate.

The Lynnwood soil is very deep and somewhat excessively drained. It formed in glacial outwash. Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown loamy fine sand. The upper 15 inches of the subsoil is dark yellowish brown loamy fine sand. The lower 5 inches is olive brown fine sand. The substratum to a depth of 60 inches is olive fine sand. In some areas the surface layer is sandy loam or loam. In other areas the soil has 15 to 25 percent pebbles in the substratum or is 14 to 24 inches deep to loamy sand or sand.

Permeability is rapid in the Lynnwood soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used as pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used as woodland, hayland, or pasture. In the areas used for hay and pasture, the main limitations are the slope of both soils and the moderate available water capacity of the Lynnwood soil. In summer, irrigation is required for maximum production.

Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder and western redcedar. The common forest understory plants are western swordfern, western brackenfern, Oregongrape, sala! red huckleberry, ladyfern, deer fern, and evergreen huckleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 168 on the Ragnar soil and 154 on the Lynnwood soil. On the basis of a 50-year site curve, it is 126 on the Ragnar soil and 121 on the Lynnwood soil. On the Ragnar soil the highest average growth rate in unmanaged, even-aged stands of Douglas fir is 179 cubic feet per acre per year, occurring at age 60. On the Lynnwood soil it is 163 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of

wheeled and tracked equipment when the soils are wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soils. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soils are moist, a moderate degree of soil displacement when the soils are dry, and a moderate degree of puddling when the soils are wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and mortality are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

The Ragnar soil is in capability subclass IIIe. The Lynnwood soil is in capability subclass IVs.

206—Ragnar-Lynnwood complex, 30 to 45 percent slopes. This map unit is on terraces. The native vegetation is mainly conifers and shrubs. Elevation is 300 to 600 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 180 days.

This unit is 45 percent Ragnar loam and 45 percent Lynnwood loamy fine sand. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Barneston soils and Lynnwood and Ragnar soils that have slopes of more than 45 percent or less than 30 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Ragnar soil is very deep and well drained. It formed in glacial outwash. Typically, the surface layer is covered with a mat of undecomposed needles, leaves, and twigs 1 inch thick. The surface layer is dark brown

loam 13 inches thick. The subsoil is dark yellowish brown sandy loam 11 inches thick. The substratum to a depth of 60 inches is light olive brown loamy sand. Depth to the substratum ranges from 20 to 30 inches. In some areas the surface layer is sandy loam. In other areas the substratum has 15 to 40 percent pebbles. In places the combined thickness of the surface layer and subsoil is 8 to 20 inches.

Permeability is moderately rapid in the Ragnar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Lynnwood soil is very deep and somewhat excessively drained. It formed in glacial outwash. Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown loamy fine sand. The upper 15 inches of the subsoil is dark yellowish brown loamy fine sand. The lower 5 inches is olive brown fine sand. The substratum to a depth of 60 inches is olive fine sand. In some areas the surface layer is sandy loam or loam. In other areas the soil has 15 to 25 percent pebbles in the substratum or is 14 to 24 inches deep to loamy sand or sand.

Permeability is rapid in the Lynnwood soil. Available water capacity is moderate. The effective rooting depth is 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder and western redcedar. The common forest understory plants are western swordfern, western brackenfern, Oregon grape, salal, red huckleberry, ladyfern, deer fern, and evergreen huckleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 168 on the Ragnar soil and 154 on the Lynnwood soil. On the basis of a 50-year site curve, it is 126 on the Ragnar soil and 121 on the Lynnwood soil. On the Ragnar soil the highest average growth rate in unmanaged, even-aged stands of Douglas fir is 179 cubic feet per acre per year, occurring at age 60. On the Lynnwood soil it is 163 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soils are moist, a moderate degree of puddling when the soils are wet, and a moderate degree of soil displacement

when the soils are dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment and mortality are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

The Ragnar soil is in capability subclass VIe. The Lynnwood soil is in capability subclass VIi.

207—Reggad very cobbly muck, 30 to 90 percent slopes. This very deep, excessively drained soil is on mountain back slopes. It formed in a mixture of organic material, volcanic ash, and pumice over rock rubble. The native vegetation is mainly shrubs. Elevation is 2,800 to 6,000 feet. The average annual precipitation is about 95 inches, and the average annual air temperature is about 41 degrees F. The average frost-free period is about 100 days.

When mixed to a depth of 8 inches, the upper part of the surface layer is very dark brown very cobbly muck. The lower part is very dark grayish brown very cobbly sapric material 9 inches thick. The underlying material to a depth of 60 inches is dark yellowish brown angular rock fragments. In some areas the lower part of the surface layer is very cobbly sandy loam or very cobbly loamy sand. In other areas the soil is 10 to 14 inches deep to the angular rock fragments.

Included in this unit are small areas of Klapatche, Playco, Reichel, and Treen soils, Rock outcrop, Rubble land, and Reggad soils that have slopes of more than 90 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is very rapid in the Reggad soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for wildlife habitat. The native vegetation is vine maple, Sitka alder, tall blue huckleberry, western swordfern, and devilsclub. Rock for road construction is readily available. Road construction is difficult because of the loose, angular rock fragments. The instability of this material when undercut results in rock movement and costly road maintenance.

This unit is in capability subclass VIIIs.

208—Reggad-Haywire complex, 45 to 90 percent slopes. This map unit is on mountain back slopes and ridgetops. The native vegetation is mainly shrubs and some conifers. Elevation is 3,400 to 6,000 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 41 degrees F. The average frost-free period is about 100 days.

This unit is 70 percent Reggad very cobbly muck and 20 percent Haywire sandy loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Klapatche, Playco, Serene, and Treen soils and Reggad and Haywire soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage.

The Reggad soil is very deep and excessively drained. It formed in a mixture of organic material, volcanic ash, and pumice over rock rubble. When mixed to a depth of 8 inches, the upper part of the surface layer is very dark brown very cobbly muck. The lower part is very dark grayish brown very cobbly sapric material 9 inches thick. The underlying material to a depth of 60 inches is dark yellowish brown angular rock fragments. In some areas the lower part of the surface layer is very cobbly sandy loam or very cobbly loamy sand. In other areas the soil is 10 to 14 inches deep to the angular rock fragments.

Permeability is very rapid in the Reggad soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

The Haywire soil is moderately deep to bedrock and is well drained. It formed in volcanic ash and pumice over colluvium and residuum derived from extrusive igneous rocks. Typically, the surface is covered with a mat of needles and twigs 1 inch thick. When mixed to a depth of 4 inches, the surface layer is dusky red sandy loam. The upper 5 inches of the subsoil is dark reddish brown loam. The next 8 inches is dark reddish brown gravelly loam. The lower 8 inches is dark brown very cobbly loam. The substratum is dark yellowish brown extremely cobbly loam 11 inches thick. Andesite is at a

depth of about 36 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, loam, or gravelly loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Permeability is moderate in the Haywire soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used mainly for wildlife habitat. The Haywire soil also is used as woodland. The Reggad soil is poorly suited to woodland.

Western hemlock and Pacific silver fir are the main woodland species on the Haywire soil. Among the trees of limited extent is noble fir. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, deer fern, prince's pine, salal, dwarf huckleberry, pachystima, and Oregon grape. The native vegetation on the Reggad soil is vine maple, Sitka alder, tall blue huckleberry, western swordfern, and devil's club.

On the basis of a 100-year site curve, the mean site index for western hemlock on the Haywire soil is 87. On the basis of a 50-year site curve, it is 59. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 100 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the very cobbly Reggad soil, which makes up about 70 percent of this unit.

The main limitations affecting timber harvesting are the cobbles in the Reggad soil, snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Road construction on the Reggad soil is difficult because of the loose, angular rock fragments. The instability of this material when undercut results in rock movement and costly road maintenance. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and

filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soils are moist and a moderate degree of puddling when the soils are wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings on the Haywire soil. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock underlying the Haywire soil, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Reggad soil is in capability subclass VIIIs. The Haywire soil is in capability subclass VIIe.

209—Reggad-Klapatche-Rock outcrop complex, 45 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly shrubs and some conifers. Elevation is 2,800 to 4,000 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 110 days.

This unit is 45 percent Reggad very cobbly loam, 20 percent Klapatche loamy sand, and 15 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Playco and Treen soils, talus, and Reggad and Klapatche soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Reggad soil is very deep and excessively drained. It formed in a mixture of organic material, volcanic ash, and pumice over rock rubble. When mixed

to a depth of 8 inches, the upper part of the surface layer is very dark brown very cobbly muck. The lower part is very dark grayish brown very cobbly sapric material 9 inches thick. The underlying material to a depth of 60 inches is dark yellowish brown angular rock fragments. In some areas the lower part of the surface layer is very cobbly sandy loam or very cobbly loamy sand. In other areas the soil is 10 to 14 inches deep to the angular rock fragments.

Permeability is very rapid in the Reggad soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

The Klapatche soil is moderately deep to bedrock and is well drained. It formed in a mixture of volcanic ash and pumice over colluvium derived dominantly from granitic and metamorphic rocks. Typically, the surface is covered with a mat of needles, twigs, bark, and moss 2 inches thick. When mixed to a depth of 8 inches, the surface layer is dark reddish brown loamy sand. The upper 4 inches of the subsoil is yellowish red and dark reddish brown very gravelly sandy loam. The lower 8 inches is strong brown very gravelly loamy sand. The upper 11 inches of the substratum is very pale brown extremely cobbly sand. The lower 7 inches is light gray, highly weathered granodiorite. Hard granodiorite is at a depth of about 38 inches. The depth to hard granitic or metamorphic rocks ranges from 30 to 40 inches. In some areas the surface layer is sandy loam, gravelly loamy sand, or very gravelly loamy sand. In other areas the soil has a substratum of very gravelly sandy loam, has 15 to 35 percent rock fragments in the subsoil, or is 40 to 60 inches deep over bedrock.

Permeability is moderately rapid in the Klapatche soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or severe.

Typically, the Rock outcrop is granitic or metamorphic rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used mainly for wildlife habitat. The Klapatche soil also is used as woodland. The Reggad soil is poorly suited to woodland.

Western hemlock and Pacific silver fir are the main woodland species on the Klapatche soil. Among the trees of limited extent are noble fir, Douglas fir, and Alaska cedar. The common forest understory plants are huckleberry, common beargrass, salal, longtube twinflower, bunchberry dogwood, Oregongrape, princes pine, and Sitka alder. The native vegetation on the Reggad soil is vine maple, Sitka alder, tall blue huckleberry, western swordfern, and devilsclub.

On the basis of a 100-year site curve, the mean site

index for western hemlock on the Klapatche soil is estimated to be 101. On the basis of a 50-year site curve, it is estimated to be 72. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 144 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop and the very cobbly Reggad soil, which make up about 60 percent of this unit.

The main limitations affecting timber harvesting are the cobbles in the Reggad soil, snowpack, the Rock outcrop, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Road construction on the Reggad soil is difficult because of the loose, angular rock fragments. The instability of this material when undercut results in rock movement and costly road maintenance. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soils are dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soils. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and

naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings on the Klapatche soil. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation. Because the rooting depth is restricted by the bedrock underlying the Klapatche soil, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Reggad soil and the Rock outcrop are in capability subclass VIIIs. The Klapatche soil is in capability subclass VII.

210—Reggad-Serene complex, 45 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly shrubs and some conifers. Elevation is 3,600 to 6,000 feet. The average annual precipitation is about 95 inches, and the average annual air temperature is about 41 degrees F. The average frost-free period is about 100 days.

This unit is 70 percent Reggad very cobbly loam and 20 percent Serene gravelly sandy loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Haywire and Treen soils and Reggad and Serene soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage.

The Reggad soil is very deep and excessively drained. It formed in a mixture of organic material, volcanic ash, and pumice over rock rubble. When mixed to a depth of 8 inches, the upper part of the surface layer is very cobbly muck. The lower part is very dark brown very cobbly sapric material 9 inches thick. The underlying material to a depth of 60 inches is dark yellowish brown angular rock fragments. In some areas the lower part of the surface layer is very cobbly sandy loam or very cobbly loamy sand. In other areas the soil is 10 to 14 inches deep to the angular rock fragments.

Permeability is very rapid in the Reggad soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

The Serene soil is moderately deep to weathered bedrock and is well drained. It formed in a mixture of volcanic ash, pumice, and colluvium derived from granitic and low-grade metamorphic rocks. Typically, the surface is covered with a mat of needles, twigs, and bark 2 inches thick. When mixed to a depth of 6 inches,

the surface layer is dark reddish brown gravelly sandy loam. The subsoil is dark yellowish brown very gravelly loamy sand 8 inches thick. The substratum is olive brown extremely cobbly coarse sand 16 inches thick. Highly weathered granodiorite is at a depth of about 30 inches. The depth to granodiorite ranges from 20 to 40 inches. In some areas the surface layer is sandy loam, loamy sand, or gravelly loamy sand. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Permeability is rapid in the Serene soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used mainly for wildlife habitat. The Serene soil also is used as woodland. The Reggad soil is poorly suited to woodland.

Western hemlock and Pacific silver fir are the main woodland species on the Serene soil. Among the trees of limited extent are noble fir and mountain hemlock. The common forest understory plants on the Serene soil are common beargrass, longtube twinflower, bunchberry dogwood, huckleberry, deer fern, princes pine, lupine, salal, cascade azalea, and trailing blackberry. The native vegetation on the Reggad soil is vine maple, Sitka alder, tall blue huckleberry, western swordfern, and devilsclub.

On the basis of a 100-year site curve, the mean site index for western hemlock on the Serene soil is estimated to be 91. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 107 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the very cobbly Reggad soil, which makes up about 70 percent of this unit.

The main limitations affecting timber harvesting are the cobbles in the Reggad soil, snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Road construction on the Reggad soil is difficult because of

the loose, angular rock fragments. The instability of this material when undercut results in rock movement and costly road maintenance. Cut and fill slopes tend to ravel when dry. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soils are dry. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings on the Serene soil. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock underlying the Serene soil, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Reggad soil is in capability subclass VIIIs. The Serene soil is in capability subclass VIIs.

211—Reichel silt loam, 6 to 30 percent slopes. This deep, well drained soil is on mountain ridgetops and back slopes. It formed in a mixture of volcanic ash and colluvium and residuum derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of undecomposed needles, leaves, and twigs 3 inches thick. The upper 10 inches of the surface layer is very dark brown silt loam. The lower part is very dark grayish brown silt loam 8 inches thick. The subsoil is dark yellowish brown gravelly loam 10 inches thick. The substratum is dark brown very gravelly clay loam 19 inches thick. Andesite is at a depth of about 47 inches. The depth to andesite ranges from 40 to 60 inches. In some areas the surface layer is loam. In other areas the

soil has less than 6 percent organic carbon in the upper part of the subsoil.

Included in this unit are small areas of Nagrom, Spukwush, and Stahl soils and Reichel soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Reichel soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, and Alaska cedar. The common forest understory plants are red huckleberry, Pacific trillium, Oregon grape, western brackenfern, prince pine, Oregon oxalis, false Solomons seal, and ladyfern.

On the basis of a 100-year site curve, the mean site index is 138 for western hemlock and 131 for Douglas fir. On the basis of a 50-year site curve, it is 98 for western hemlock and 100 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 214 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 132 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from December through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock, noble fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIe.

212—Reichel silt loam, 30 to 65 percent slopes.

This deep, well drained soil is on mountain ridgetops and back slopes. It formed in a mixture of volcanic ash and colluvium and residuum derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of undecomposed needles, leaves, and twigs 3 inches thick. The surface layer is very dark brown silt loam 10 inches thick. The upper 8 inches of the subsoil is very dark grayish brown silt loam. The lower 10 inches is dark yellowish brown gravelly clay loam. The substratum is dark brown very gravelly clay loam 19 inches thick. Andesite is at a depth of about 47 inches. The depth to andesite ranges from 40 to 60 inches. In some areas the surface layer is loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil.

Included in this unit are small areas of Nagrom, Spukwush, and Stahl soils and Reichel soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Reichel soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, and Alaska cedar. The common forest understory plants are red huckleberry, Pacific trillium, Oregon grape, western brackenfern, prince pine, Oregon oxalis, false Solomons seal, and ladyfern.

On the basis of a 100-year site curve, the mean site index is 138 for western hemlock and 131 for Douglas fir. On the basis of a 50-year site curve, it is 98 for

western hemlock and 100 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 214 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 132 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from December through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock, noble fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

213—Reichel silt loam, tuff substratum, 15 to 30 percent slopes. This very deep, well drained soil is on mountain ridgetops and back slopes. It formed in a

mixture of volcanic ash and colluvium and residuum derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of undecomposed needles, leaves, and twigs 3 inches thick. The surface layer is dark brown silt loam 14 inches thick. The subsoil is dark brown and dark yellowish brown gravelly loam 31 inches thick. The substratum to a depth of 60 inches is very dark grayish brown very gravelly loam. The depth to breccia or tuff ranges from 40 to 80 inches. In some areas the surface layer is loam. In other areas the soil has less than 6 percent organic carbon in the subsoil.

Included in this unit are small areas of Nagrom, Spukwush, and Stahl soils and Reichel soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Reichel soil. Available water capacity is high. The effective rooting depth is 40 to more than 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, and Alaska cedar. The common forest understory plants are red huckleberry, Pacific trillium, Oregongrape, western brackenfern, princes pine, Oregon oxalis, false Solomons seal, and ladyfern.

On the basis of a 100-year site curve, the mean site index is 138 for western hemlock and 131 for Douglas fir. On the basis of a 50-year site curve, it is 98 for western hemlock and 100 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 214 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 132 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from December through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the

available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock, noble fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIe.

214—Reichel silt loam, tuff substratum, 30 to 65 percent slopes. This very deep, well drained soil is on mountain ridgetops and back slopes. It formed in a mixture of volcanic ash and colluvium and residuum derived dominantly from breccia. The native vegetation is mainly conifers and shrubs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of undecomposed needles, leaves, and twigs 3 inches thick. The surface layer is dark brown silt loam 14 inches thick. The subsoil is dark brown and dark yellowish brown gravelly loam 31 inches thick. The substratum to a depth of 60 inches is very dark grayish brown very gravelly loam. The depth to breccia or tuff ranges from 40 to more than 60 inches. In some areas the surface layer is loam. In other areas the soil has less than 6 percent organic carbon in the subsoil.

Included in this unit are small areas of Nagrom,

Spukwush, and Stahl soils and Reichel soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Reichel soil. Available water capacity is high. The effective rooting depth is 40 to more than 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, and Alaska cedar. The common forest understory plants are red huckleberry, Pacific trillium, Oregon grape, western brackenfern, prince pine, Oregon oxalis, false Solomons seal, and ladyfern.

On the basis of a 100-year site curve, the mean site index is 138 for western hemlock and 131 for Douglas fir. On the basis of a 50-year site curve, it is 98 for western hemlock and 100 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 214 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 132 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from December through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep yarding paths, skid trails, and firebreaks are subject to

rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting western hemlock, noble fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

215—Riverwash. This map unit is on bottom land along rivers. It is frequently flooded. Slope is 0 to 2 percent. Areas are irregular in shape and are 5 to 100 acres in size. The native vegetation is mainly small trees, scattered shrubs, and grass. Most areas, however, are unvegetated. Elevation is 40 to 900 feet. The average annual precipitation is 50 to 90 inches, and the average annual air temperature is 46 to 49 degrees F. The average frost-free period is 150 to 190 days.

No single profile is representative of this unit. In one of the more commonly observed ones, however, stratified cobbles, pebbles, and sand extend to a depth of 60 inches.

Included in this unit are small areas of Pilchuck and Snoqualmie soils on flood plains, Xerorthents on low terraces, and bodies of water. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid or very rapid in the Riverwash. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is severe because of the susceptibility to flooding and channeling. Channeling and deposition are common along streambanks. This unit is subject to frequent, long or very long periods of flooding from October through July. The seasonal high water table is within a depth of 2 feet throughout the year.

This unit is used mainly for wildlife habitat and recreational development. It also is a source of sand and gravel; however, riverside habitat is destroyed by obtaining these materials. The main limitations affecting woodland, pasture, or cropland are the frequent flooding and a lack of soil fertility.

This unit is in capability subclass VIIIw.

216—Rober loam, 0 to 30 percent slopes. This very deep, moderately well drained soil is on mountain back slopes and plateaus. It formed in volcanic ash and glaciolacustrine sediments. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 5 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown loam. The subsoil is dark brown and dark yellowish brown loam 24 inches thick. The substratum to a depth of 60 inches is grayish brown, mottled silt loam. In some areas, the surface layer is silt loam and the substratum is stratified with silty clay loam.

Included in this unit are small areas of Klaus, Pastik, Philippa, and Teneriffe soils, poorly drained mineral soils in depressions, and Rober soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Rober soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a depth of 2.0 to 3.5 feet from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are western swordfern, brackenfern, ladyfern, red huckleberry, Oregongrape, red elderberry, and vine maple.

On the basis of a 100-year site curve, the mean site index is 154 for Douglas fir and 153 for western hemlock. On the basis of a 50-year site curve, it is 121 for Douglas fir and 108 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 163 cubic feet per acre per year, occurring at age 60. For western hemlock it is 243 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

217—Rober loam, 30 to 65 percent slopes. This very deep, moderately well drained soil is on mountain back slopes. It formed in volcanic ash and glaciolacustrine sediments. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,800 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 140 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 5 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown loam. The subsoil is dark brown and dark yellowish brown loam 24 inches thick. The substratum to a depth of 60 inches is grayish brown, mottled silt loam. In some areas the surface layer is silt loam.

Included in this unit are small areas of Klaus, Pastik, Philippa, and Teneriffe soils, poorly drained mineral soils in depressions, and Rober soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Rober soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a depth of 2.0 to 3.5 feet from December through May. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are

western swordfern, brackenfern, ladyfern, red huckleberry, Oregongrape, red elderberry, and vine maple.

On the basis of a 100-year site curve, the mean site index is 154 for Douglas fir and 153 for western hemlock. On the basis of a 50-year site curve, it is 121 for Douglas fir and 108 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 163 cubic feet per acre per year, occurring at age 60. For western hemlock it is 243 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are occasional snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the seasonal high water table, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

218—Rock outcrop. This map unit is on mountainsides and ridges. Slope is 70 to more than 100 percent. Areas are irregular in shape and are 5 to 400 acres in size. Elevation is 1,000 to 5,200 feet.

Typically, the Rock outcrop is granite, andesite, breccia, or metasedimentary rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

Included in this unit are soils in areas too small to be mapped at the selected scale and small areas of Rubble land. Included areas make up about 10 percent of the total acreage.

Runoff is rapid on the Rock outcrop, and the hazard of water erosion is severe. This unit is used for rock quarries and wildlife habitat.

This unit is in capability subclass VIIIs.

219—Rock outcrop-Cattcreek complex, 65 to 90 percent slopes. This map unit is on mountain back slopes and in cirque basins. The native vegetation is mainly conifers and shrubs. Elevation generally is 2,800 to 4,000 feet. Some areas, however, extend to 5,300 feet. The average annual precipitation is about 105 inches, and the average annual air temperature is about 39 degrees F. The average frost-free period is about 110 days.

This unit is 50 percent Rock outcrop and 40 percent Cattcreek very cindery loamy sand. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Cottoral soils, soils that are less than 20 inches deep and vary in content of rock fragments, organic soils in depressions, and Cattcreek soils that have slopes of less than 65 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the Rock outcrop is andesite. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

The Cattcreek soil is very deep and well drained. It formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. The surface layer is dark brown very cindery loamy sand 7 inches thick. The upper 4 inches of the subsoil is strong brown very cindery loamy sand. The lower 10 inches is strong brown very cindery sand. The substratum to a depth of 60 inches is dark yellowish brown and olive brown very gravelly sandy loam. In some areas the surface layer is extremely cindery loamy sand or cindery loamy sand. In other areas the soil is 40 to 60 inches deep to andesite or sandstone, has 15 to 35 percent rock fragments in the substratum, or is 30 to 60 inches deep to dense glacial till.

Permeability is very rapid in the upper part of the

Cattcreek soil and moderate in the substratum. Available water capacity is moderate. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir, western redcedar, western white pine, and Alaska cedar. The common forest understory plants are common beargrass, longtube twinflower, western brackenfern, evergreen blackberry, black mountain huckleberry, princes pine, and tall blue huckleberry.

On the basis of a 100-year site curve, the mean site index is 124 for western hemlock and is estimated to be 117 for Douglas fir. On the basis of a 50-year site curve, it is 86 for western hemlock and is estimated to be 90 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 188 cubic feet per acre per year, occurring at age 50. For Douglas fir it is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 50 percent of this unit.

The main limitations affecting timber harvesting are the slope, the Rock outcrop, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity.

Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in

compaction of the soil. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting Douglas fir, noble fir, or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation. Trees are occasionally subject to windthrow because the surface layer and subsoil are loose.

The Rock outcrop is in capability subclass VIIIs. The Cattcreek soil is in capability subclass VIIe.

220—Rock outcrop-Cayuse complex, 30 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 5,000 to 6,200 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 38 degrees F. The average frost-free period is about 95 days.

This unit is 50 percent Rock outcrop and 30 percent Cayuse sandy loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils with that have more than 35 percent rock fragments throughout, soils that are less than 20 inches deep and vary in content of rock fragments, organic soils in depressions, and Cayuse soils that have slopes of less than 30 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Typically, the Rock outcrop is andesite or basalt. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

The Cayuse soil is very deep and well drained. It formed in volcanic ash and pumice over residuum and colluvium derived dominantly from andesite or basalt. Typically, the surface is covered with a mat of needles, twigs, and moss 0.25 inch thick. The upper 4 inches of the surface layer is very dark grayish brown sandy

loam. The lower 9 inches is dark brown sandy loam. The upper 17 inches of the subsoil is brown loam. The lower 6 inches is dark yellowish brown gravelly loam. The substratum to a depth of 60 inches is variegated dark yellowish brown and yellowish brown very gravelly loam. In some areas the surface layer is loamy sand. In other areas the soil has 15 to 35 percent rock fragments in the lower part of the subsoil and in the substratum.

Permeability is moderate in the Cayuse soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are subalpine fir and Engelmann spruce. The common forest understory plants are fawnlily, wild ginger, roughfruit berry, tall blue huckleberry, oneleaf foamflower, bunchberry dogwood, and lambstongue fawnlily.

On the basis of a 100-year site curve, the mean site index for western hemlock is 77. On the basis of a 50-year site curve, it is 55. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 84 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 50 percent of this unit.

The main limitations affecting timber harvesting are the Rock outcrop, the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through June. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting noble fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation.

The Rock outcrop is in capability subclass VIIIs. The Cayuse soil is in capability subclass VIIe.

221—Rock outcrop-Haywire complex, 45 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 6,000 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

This unit is 50 percent Rock outcrop and 40 percent Haywire sandy loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Klapatche, Playco, and Serene soils, Rubble land, soils that are less than 20 inches deep and vary in content of rock fragments, organic soils in depressions, and Haywire soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the Rock outcrop is andesite or basalt. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

The Haywire soil is moderately deep to bedrock and is well drained. It formed in volcanic ash and pumice over colluvium and material weathered from extrusive igneous rocks. Typically, the surface is covered with a mat of needles and twigs 1 inch thick. When mixed to a

depth of 4 inches, the surface layer is dusky red sandy loam. The upper 5 inches of the subsoil is dark reddish brown loam. The next 8 inches is dark reddish brown gravelly loam. The lower 8 inches is dark brown very cobbly loam. The substratum is dark yellowish brown extremely cobbly loam 11 inches thick. Andesite is at a depth of about 36 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, loam, or gravelly loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Permeability is moderate in the Haywire soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used mainly for wildlife habitat. The Haywire soil also is used as woodland.

Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, deer fern, prince's pine, salal, dwarf huckleberry, pachystima, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is 87. On the basis of a 50-year site curve, it is 59. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 100 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 50 percent of this unit.

The main limitations affecting timber harvesting are the Rock outcrop, snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to

occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. The Rock outcrop prevents the even distribution of reforestation. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Rock outcrop is in capability subclass VIIIs. The Haywire soil is in capability subclass VIIe.

222—Rock outcrop-Rubble land-Haywire complex, 45 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 3,400 to 6,000 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

This unit is 35 percent Rock outcrop, 30 percent Rubble land, and 25 percent Haywire sandy loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Klapatche, Playco, and Serene soils, soils that are less than 20

inches deep and vary in content of rock fragments, organic soils in depressions, and Haywire soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the Rock outcrop is andesite or basalt. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

The Rubble land is on talus slopes. It consists of angular stones and boulders.

The Haywire soil is moderately deep to bedrock and is well drained. It formed in volcanic ash and pumice over colluvium and material weathered from extrusive igneous rocks. Typically, the surface is covered with a mat of needles and twigs 1 inch thick. When mixed to a depth of 4 inches, the surface layer is dusky red sandy loam. The upper 5 inches of the subsoil is dark reddish brown loam. The next 8 inches is dark reddish brown gravelly loam. The lower 8 inches is dark brown very cobbly loam. The substratum is dark yellowish brown extremely cobbly loam 11 inches thick. Andesite is at a depth of about 36 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is loamy sand, loam, or gravelly loam. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Permeability is moderate in the Haywire soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used mainly for wildlife habitat. It also is used as a source of aggregate. The Haywire soil is used as woodland.

Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is noble fir. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, black mountain huckleberry, deer fern, prince's pine, salal, dwarf huckleberry, pachystima, and Oregon grape. The native vegetation on the Rubble land is sparse. It consists mainly of huckleberry, ferns, and forbs.

On the basis of a 100-year site curve, the mean site index for western hemlock is 87. On the basis of a 50-year site curve, it is 59. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 100 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop and the Rubble land, which make up about 65 percent of this unit.

The main limitations affecting timber harvesting are the Rock outcrop, the Rubble land, snowpack, the

slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop and Rubble land on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop or the Rubble land. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available on this unit. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Because of the Rock outcrop and the Rubble land, yarding and skidding paths converge. This convergence results in compaction of the soil. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. The Rock outcrop and

the Rubble land prevent the even distribution of reforestation. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Rock outcrop and the Rubble land are in capability subclass VIIIs. The Haywire soil is in capability subclass VIIe.

223—Rock outcrop-Rubble land-Serene complex, 45 to 90 percent slopes. This map unit is on mountain back slopes. The native vegetation is mainly conifers and shrubs. Elevation is 3,600 to 6,000 feet. The average annual precipitation is about 95 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

This unit is 35 percent Rock outcrop, 30 percent Rubble land, and 25 percent Serene gravelly sandy loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Haywire and Reggad soils, soils that are less than 20 inches deep and vary in content of rock fragments, organic soils in depressions, and Serene soils that have slopes of less than 45 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Typically, the Rock outcrop is granite and low-grade metamorphic rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

The Rubble land is on talus slopes. It consists of angular stones and boulders.

The Serene soil is moderately deep to weathered bedrock and is well drained. It formed in a mixture of volcanic ash, pumice, and colluvium derived from granitic and low-grade metamorphic rocks. Typically, the surface is covered with a mat of needles, twigs, and bark 2 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 8 inches of the subsoil is dark yellowish brown very gravelly loamy sand. The lower 16 inches is olive brown extremely cobbly coarse sand. Highly weathered granodiorite is at a depth of about 30 inches. The depth to granodiorite ranges from 20 to 40 inches. In some areas the surface layer is sandy loam, loamy sand, or gravelly loamy sand. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Permeability is moderately rapid in the Serene soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used mainly as wildlife habitat. It also is

used as a source of aggregate. The Serene soil is used as woodland.

Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and mountain hemlock. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, huckleberry, deer fern, princes pine, lupine, salal, cascade azalea, and trailing blackberry. The native vegetation on the Rubble land is sparse. It consists mainly of huckleberry, ferns, and forbs.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 91. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 107 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop and the Rubble land, which make up about 65 percent of this unit.

The main limitations affecting timber harvesting are the Rock outcrop, the Rubble land, snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop and the Rubble land on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop or the Rubble land. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Because of the Rock outcrop and the Rubble land, yarding and skidding paths converge. This convergence results in compaction of the soil. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying

out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop and the Rubble land prevent the even distribution of reforestation. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Rock outcrop and the Rubble land are in capability subclass VIIIs. The Serene soil is in capability subclass VIIIs.

224—Rubble land. This map unit is on talus slopes at the base of rock outcrops. It consists of angular stones and boulders. Slope is 30 to 100 percent. The native vegetation is sparse. It is mainly huckleberry, ferns, and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 70 to 100 inches, and the average annual air temperature is 40 to 43 degrees F. The average frost-free period is 80 to 100 days.

Typically, this unit is loosely piled, angular stones and boulders to a depth of 60 inches.

Included in this unit are small areas of Rock outcrop and areas where the rubble is less than 60 inches deep. Included areas make up about 10 percent of the total acreage.

This unit is used for wildlife habitat and as a source of aggregate.

This unit is in capability subclass VIIIs.

225—Rugles silt loam, 0 to 15 percent slopes. This very deep, well drained soil is on dissected terraces. It formed in a mixture of lacustrine deposits and tephra. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,400 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of

partially decomposed needles and twigs 2 inches thick. When mixed to a depth of 11 inches, the surface layer is dark brown silt loam. The upper 34 inches of the subsoil is dark brown and grayish brown silt loam. The lower 12 inches is grayish brown silt loam. The substratum to a depth of 60 inches is grayish brown silty clay loam. In some areas the surface layer is loam. In other areas the soil has a seasonal high water table at a depth of 40 to 60 inches from December through April.

Included in this unit are small areas of Jonas, Rober, and Zynbar soils, poorly drained mineral soils in depressions, and Rugles soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Rugles soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, red alder, black cottonwood, Sitka spruce, and western redcedar. The common forest understory plants are western swordfern, deer fern, bedstraw, red huckleberry, trillium, western brackenfern, and vine maple.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 170. On the basis of a 50-year site curve, it is 129. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 181 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are

available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

226—Salal silt loam, 0 to 2 percent slopes. This very deep, moderately well drained soil is on river terraces and flood plains. It formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 400 to 500 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 150 days.

Typically, the upper 11 inches of the surface layer is black silt loam. The lower 39 inches is very dark grayish brown silt loam. The underlying material to a depth of 60 inches is dark grayish brown silt loam. In some areas the surface layer is very fine sandy loam. In other areas the soil has a substratum that is stratified with fine sandy loam and sand, has sand at a depth of 40 to 60 inches, or has more than 50 percent base saturation in the surface layer.

Included in this unit are small areas of Edgewick and Si soils and Salal soils that have slopes of more than 2 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Salal soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at a depth of 3 or 4 feet from February through April. Runoff is very slow, and there is no hazard of erosion. This soil is subject to occasional, brief periods of flooding from November through March.

This unit is used mainly as hayland, pasture, or cropland. It also is used as woodland and as a site for homes.

In the areas used for hay and pasture, the main limitation is the seasonal high water table. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and help to control runoff and erosion.

The main limitation in the areas used as cropland is the seasonal high water table. This unit is suited to all of the crops commonly grown in the survey area. The principal crops are oats and corn silage. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are western redcedar, western hemlock, and red alder. The common forest understory plants are trailing blackberry, salmonberry, western

swordfern, red elderberry, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 151. On the basis of a 50-year site curve, it is estimated to be 115. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 159 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are the muddiness caused by seasonal wetness and the hazard of flooding. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. The occasional flooding hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

In the areas used for homesite development, the main limitations are the flooding and the seasonal high water table. The seasonal high water table increases the likelihood that septic tank absorption fields will fail. Installing the absorption field in fill approved by the health district helps to overcome these limitations.

This unit is in capability subclass IIIw.

227—Sauk silt loam, 0 to 8 percent slopes. This very deep, well drained soil is on river terraces. It formed in alluvium containing volcanic ash. The native vegetation is mainly conifers and shrubs. Elevation is 500 to 800 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 49 degrees F. The average frost-free period is about 155 days.

Typically, the surface layer is covered with a mat of needles, leaves, and twigs 1.5 inches thick. The surface

layer is very dark brown silt loam 6 inches thick. The upper 16 inches of the subsoil is dark brown silt loam and dark yellowish brown fine sandy loam. The lower 20 inches is olive brown and dark brown fine sandy loam. The substratum to a depth of 60 inches is olive brown very gravelly loamy sand. Depth to the substratum ranges from 40 to 60 inches. In some areas the surface layer is loam or fine sandy loam. In other areas the substratum has 15 to 35 percent rock fragments or is below a depth of 60 inches.

Included in this unit are small areas of Persis, Pilchuck, Shalcar, and Sultan soils and Sauk soils that are occasionally flooded for brief periods or that have slopes of more than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Sauk soil and rapid in the substratum. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very slow, and there is no hazard of erosion.

This unit is used mainly as woodland. It also is used for hay and pasture.

This unit is well suited to hay and pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Grazing when the soil is wet results in compaction of the surface layer and poor tilth. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are bigleaf maple, red alder, western hemlock, and western redcedar. The common forest understory plants are Oregongrape, western brackenfern, western swordfern, salmonberry, vine maple, and red huckleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 173. On the basis of a 50-year site curve, it is estimated to be 130. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 184 cubic feet per acre per year, occurring at age 60.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can

reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, red alder, or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIe.

228—Scamman silt loam, 6 to 15 percent slopes.

This very deep, somewhat poorly drained soil is on terraces. It formed in glacial and sedimentary material. The native vegetation is mainly trees and shrubs. Elevation is 800 to 1,700 feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 175 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. The surface layer is dark yellowish brown silt loam 6 inches thick. The subsurface layer is light brownish gray silt loam 8 inches thick. The upper 13 inches of the subsoil is grayish brown, mottled silty clay. The lower part to a depth of 60 inches is dark grayish brown, mottled silty clay. In some areas the surface layer is silty clay loam. In other areas the soil has 20 to 35 percent clay or more than 60 percent clay in the subsoil. In places a substratum that has 15 to 35 percent rock fragments is below a depth of 40 inches.

Included in this unit are small areas of Mashel soils, ponded areas, and Scamman soils that have slopes of less than 6 percent or more than 15 percent. Included areas make up about 10 percent of the total acreage.

Permeability is slow in the Scamman soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a depth of 0.5 foot to 1.5 feet from November through April. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used as pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used as woodland. It also is suitable as pasture and hayland.

Douglas fir and red alder are the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, bigleaf maple, bitter cherry, and Oregon ash. The common forest understory plants are western swordfern, Oregongrape, western

brackenfern, salal, red huckleberry, trailing blackberry, salmonberry, vine maple, rose, creambush oceanspray, red elderberry, Oregon oxalis, and cascara buckthorn.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 152. On the basis of a 50-year site curve, it is 116. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 161 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of red alder have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate.

Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IIIe.

229—Scamman silt loam, 15 to 30 percent slopes.

This very deep, somewhat poorly drained soil is on terraces and on back slopes in the foothills. It formed in glacial and sedimentary material. The native vegetation is mainly trees and shrubs. Elevation is 800 to 1,700

feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 175 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. The surface layer is dark yellowish brown silt loam 6 inches thick. The subsurface layer is light brownish gray silt loam 8 inches thick. The upper 13 inches of the subsoil is grayish brown, mottled silty clay. The lower part to a depth of 60 inches is dark grayish brown, mottled silty clay. In some areas the surface layer is silty clay loam. In other areas the soil has 20 to 35 percent clay or more than 60 percent clay in the subsoil. In places a substratum that has 15 to 35 percent rock fragments is below a depth of 40 inches.

Included in this unit are small areas of Mashel soils and Scamman soils that have slopes of less than 15 percent or more than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is slow in the Scamman soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a depth of 0.5 foot to 1.5 feet from November through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. Douglas fir and red alder are the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, bigleaf maple, bitter cherry, and Oregon ash. The common forest understory plants are western swordfern, Oregon grape, western brackenfern, salal, red huckleberry, trailing blackberry, salmonberry, vine maple, rose, creambush oceanspray, red elderberry, Oregon oxalis, and cascara buckthorn.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 152. On the basis of a 50-year site curve, it is 116. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 161 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of red alder have not been made.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a

high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

230—Scamman silt loam, 30 to 65 percent slopes.

This very deep, somewhat poorly drained soil is on terraces and on back slopes in the foothills. It formed in glacial and sedimentary material. The native vegetation is mainly trees and shrubs. Elevation is 800 to 1,700 feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 175 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 4 inches thick. The surface layer is dark yellowish brown silt loam 6 inches thick. The subsurface layer is light brownish gray silt loam 8 inches thick. The upper 13 inches of the subsoil is grayish brown, mottled silty clay. The lower part to a depth of 60 inches is dark grayish brown, mottled silty clay. In some areas the surface layer is silty clay loam. In other areas the soil has 20 to 35 percent clay or more than 60 percent clay in the subsoil. In places a substratum that has 15 to 35 percent rock fragments is below a depth of 40 inches.

Included in this unit are small areas of Mashel soils and Scamman soils that have slopes of less than 30 percent or more than 65 percent. Included areas make up about 10 percent of the total acreage.

Permeability is slow in the Scamman soil. Available water capacity is high. The effective rooting depth is

limited by a perched high water table, which is at a depth of 0.5 foot to 1.5 feet from November through April. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly as woodland. Douglas fir and red alder are the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, bigleaf maple, bitter cherry, and Oregon ash. The common forest understory plants are western swordfern, Oregon grape, western brackenfern, salal, red huckleberry, trailing blackberry, salmonberry, vine maple, rose, creambush oceanspray, red elderberry, Oregon oxalis, and cascara buckthorn.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 152. On the basis of a 50-year site curve, it is 116. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 161 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of red alder have not been made.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing

plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

231—Seattle muck, 0 to 1 percent slopes. This very deep, very poorly drained soil is in depressions in river valleys and on glacial till plains. It formed in herbaceous and woody organic deposits. The native vegetation is mainly shrubs, forbs, and trees. Elevation is 300 to 800 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface layer is dark brown muck 8 inches thick. The underlying material to a depth of 60 inches is dark brown and black, stratified sapric and hemic material. In some areas the soil is all hemic material or all sapric material.

Included in this unit are small areas of Puget and Shalcar soils, ponded areas, drained Seattle soils, and Seattle soils that have slopes of more than 1 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Seattle soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at or above the surface from October through May. Runoff is very slow, and there is no hazard of erosion.

This unit is used mainly as woodland or for wildlife habitat. It also is used as pasture where drained.

In the areas used for hay and pasture, the main limitation is the high water table. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Grazing when the soil is wet results in compaction of the surface layer and poor tilth.

Red alder is the main woodland species. Among the trees of limited extent are western redcedar, black cottonwood, and Sitka spruce. The common forest understory plants are western swordfern, devilscub, vine maple, sedges, and rushes.

On the basis of a 50-year site curve, the mean site index for red alder is estimated to be 85. The highest average growth rate in unmanaged, even-aged stands of red alder is about 92 cubic feet per acre per year, occurring at age 40.

The main limitations affecting timber harvesting are the seasonal high water table and low strength. The use of wheeled and tracked equipment when the soil is wet

causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass Vw.

232—Serene gravelly sandy loam, 8 to 30 percent slopes. This well drained soil is on mountain ridge crests and back slopes. It is moderately deep to weathered bedrock. It formed in a mixture of volcanic ash, pumice, and colluvium derived dominantly from granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,600 to 6,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 2 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 8 inches of the subsoil is dark yellowish brown very gravelly loamy sand. The lower 16 inches is olive brown extremely cobbly coarse sand. Highly weathered granodiorite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is sandy loam, loamy sand, or gravelly

loamy sand. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil, is 40 to 60 inches deep over bedrock, or is underlain by conglomerate.

Included in this unit are small areas of Haywire and Reggad soils, soils that are 10 to 20 inches deep over bedrock, Rock outcrop, and Serene soils that have slopes of less than 8 percent or more than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Serene soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and mountain hemlock. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, huckleberry, deer fern, princes pine, lupine, salal, cascade azalea, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 91. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 107 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through May. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate

reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIs.

233—Serene gravelly sandy loam, 30 to 65 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to weathered bedrock. It formed in a mixture of volcanic ash, pumice, and colluvium derived dominantly from granitic and metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 3,600 to 6,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

Typically, the surface is covered with a mat of needles, twigs, bark, and moss 2 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 8 inches of the subsoil is dark yellowish brown very gravelly loamy sand. The lower 16 inches is olive brown extremely cobbly coarse sand. Highly weathered granodiorite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is sandy loam, loamy sand, or gravelly loamy sand. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil, is 40 to 60 inches deep over bedrock, or is underlain by conglomerate.

Included in this unit are small areas of Haywire and Reggad soils, soils that are 10 to 20 inches deep over bedrock, Rock outcrop, and Serene soils that have slopes of less than 30 percent or more than 65 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Serene soil.

Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and mountain hemlock. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, huckleberry, deer fern, prince's pine, lupine, salal, cascade azalea, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 91. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 107 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. If seed

trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIc.

234—Serene-Rock outcrop complex, 45 to 90 percent slopes. This map unit is on mountain back slopes and shoulder slopes. The native vegetation is mainly conifers and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is about 95 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 100 days.

This unit is 50 percent Serene gravelly sandy loam and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Haywire and Reggad soils, Rubble land, soils that are less than 20 inches deep and vary in content of rock fragments, organic soils in depressions, and Serene soils that have slopes of less than 45 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Serene soil is moderately deep to weathered bedrock and is well drained. It formed in a mixture of volcanic ash, pumice, and colluvium derived from granitic and low-grade metamorphic rocks. Typically, the surface is covered with a mat of needles, twigs, bark, and moss 2 inches thick. When mixed to a depth of 6 inches, the surface layer is dark reddish brown gravelly sandy loam. The upper 8 inches of the subsoil is dark yellowish brown very gravelly loamy sand. The lower 16 inches is olive brown extremely cobbly coarse sand. Highly weathered granodiorite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is sandy loam, loamy sand, or gravelly loamy sand. In other areas the soil has less than 6 percent organic carbon in the upper part of the subsoil or is 40 to 60 inches deep to andesite.

Permeability is moderately rapid in the Serene soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

Typically, the Rock outcrop is granite or low-grade metamorphic rocks. It is hard and mostly unweathered. It occurs as steep cliffs and irregular formations.

This unit is used mainly as woodland. It also is used as a source of aggregate and for wildlife habitat.

Western hemlock and Pacific silver fir are the main

woodland species. Among the trees of limited extent are noble fir and mountain hemlock. The common forest understory plants are common beargrass, longtube twinflower, bunchberry dogwood, huckleberry, deer fern, prince's pine, lupine, salal, cascade azalea, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 91. On the basis of a 50-year site curve, it is estimated to be 65. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 107 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of Pacific silver fir have not been made. Yields are reduced by the Rock outcrop, which makes up about 30 percent of this unit.

The main limitations affecting timber harvesting are the Rock outcrop, snowpack, the slope, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through May. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. The pattern of the Rock outcrop on the landscape, however, results in a discontinuous slope, which hinders the use of these systems. Trees can break if they are felled on the Rock outcrop. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Because of the Rock outcrop, yarding and skidding paths converge. This convergence results in compaction of the soil. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and the hazard of windthrow are

the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. A low soil temperature, deep snowpack, and a short growing season also hinder the survival of the seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock or noble fir seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The Rock outcrop prevents the even distribution of reforestation. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

The Serene soil is in capability subclass VII. The Rock outcrop is in capability subclass VIII.

235—Shalcar muck, 0 to 1 percent slopes. This very deep, very poorly drained soil is in depressions on outwash terraces, till plains, and stream terraces. It formed in herbaceous and woody organic deposits over alluvium and glaciofluvial deposits. The native vegetation is mainly shrubs, forbs, and trees. Elevation is 200 to 700 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface layer is very dark brown muck 10 inches thick. The upper 10 inches of the underlying material is very dark brown sapric material. The lower part to a depth of 60 inches is dark grayish brown sandy loam. In some areas the surface layer is hemic material. In other areas the lower part of the underlying material is below a depth of 51 inches.

Included in this unit are small areas of Seattle and Woodinville soils, ponded areas, drained Shalcar soils, and Shalcar soils that have slopes of more than 1 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Shalcar soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at or above the surface or within a depth of 1.5 feet from October through May. Runoff is very slow, and there is no hazard of erosion.

This unit is used mainly as woodland or for wildlife habitat. It also is used as pasture where drained.

In the areas used for hay and pasture, the main limitation is the seasonal high water table. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Grazing when the soil is wet results in

compaction of the surface layer and poor tilth.

Red alder is the main woodland species. Among the trees of limited extent are western redcedar, western hemlock, lodgepole pine, and Sitka spruce. The common forest understory plants are sedges, rushes, hardhack, skunk cabbage, salmonberry, trailing blackberry, and devilscub.

On the basis of a 50-year site curve, the mean site index for red alder is estimated to be 85. The highest average growth rate in unmanaged, even-aged stands of red alder is about 92 cubic feet per acre per year, occurring at age 40.

The main limitations affecting timber harvesting are the seasonal high water table and low strength. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting red alder or western redcedar seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIw.

236—Si silt loam, 0 to 2 percent slopes. This very deep, moderately well drained soil is on river terraces. It formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 400 to 500 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 150 days.

Typically, the surface layer is dark brown silt loam 11 inches thick. The subsoil is olive brown silt loam 11 inches thick. The substratum to a depth of 60 inches or more is light olive brown and olive brown, stratified silt loam and fine sandy loam. In some areas the surface layer is very fine sandy loam. In other areas the substratum does not have sandy material.

Included in this unit are small areas of Edgewick and Salal soils and Si soils that have slopes of more than 2 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Si soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at a depth of 2 to 4 feet from November through April. Runoff is very slow, and there is no hazard of erosion. This soil is subject to occasional, brief periods of flooding from February through April.

This unit is used mainly as hayland, pasture, or cropland. It also is used as woodland and as a site for homes.

In the areas used for hay and pasture, the main limitation is the seasonal high water table. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and help to control runoff and erosion.

The main limitation in the areas used as cropland is the seasonal high water table. This unit is suited to all of the crops commonly grown in the survey area. The principal crops are oats and corn silage. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are red alder, black cottonwood, and western redcedar. The common forest understory plants are western swordfern, trailing blackberry, salmonberry, and thimbleberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 160. On the basis of a 50-year site curve, it is estimated to be 120 for Douglas fir and 90 for red alder. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 170 cubic feet per acre per year, occurring at age 65. For red alder it is about 101 cubic feet per acre per year, occurring at age 40.

The main limitations affecting timber harvesting are the muddiness caused by seasonal wetness and the flooding. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high

degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. The occasional flooding hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

In the areas used for homesite development, the main limitations are the flooding and the seasonal high water table. The seasonal high water table increases the likelihood that septic tank absorption fields will fail. Installing the absorption field in fill approved by the health district helps to overcome these limitations.

This unit is in capability subclass IIIw.

237—Skykomish gravelly sandy loam, 0 to 30 percent slopes. This very deep, somewhat excessively drained soil is on terraces and escarpments. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 130 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 10 inches, the surface layer is dark brown gravelly sandy loam. The upper 5 inches of the subsoil is yellowish red very gravelly sandy loam. The lower 9 inches is dark brown very gravelly loamy sand. The substratum to a depth of 60 inches is dark grayish brown and dark brown extremely gravelly coarse sand. The depth to extremely gravelly coarse sand ranges from 14 to 30 inches. In some areas the surface layer is very gravelly sandy loam or gravelly loam. In other areas the soil has a substratum of very gravelly sandy loam or has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Elwell, Olomount, Philippa, Rober, and Teneriffe soils, stony

areas, and Skykomish soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Skykomish soil and very rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are red huckleberry, western swordfern, western brackenfern, salal, and Oregongrape.

On the basis of a 100-year site curve, the mean site index is 148 for western hemlock and 138 for Douglas fir. On the basis of a 50-year site curve, it is 106 for western hemlock and 108 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 234 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 142 cubic feet per acre per year, occurring at age 70.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and establishment are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock or Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of

cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

238—Skykomish gravelly sandy loam, 30 to 65 percent slopes. This very deep, somewhat excessively drained soil is on terraces and escarpments. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 130 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 10 inches, the surface layer is dark brown gravelly sandy loam. The upper 5 inches of the subsoil is yellowish red very gravelly sandy loam. The lower 9 inches is dark brown very gravelly loamy sand. The substratum to a depth of 60 inches is dark grayish brown and dark brown extremely gravelly coarse sand. The depth to extremely gravelly coarse sand ranges from 14 to 30 inches. In some areas the surface layer is very gravelly sandy loam or gravelly loam. In other areas the soil has a substratum of very gravelly sandy loam or has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Elwell, Olomount, Philippa, Rober, and Teneriffe soils, stony areas, and Skykomish soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Skykomish soil and very rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are red huckleberry, western swordfern, western brackenfern, salal, and Oregongrape.

On the basis of a 100-year site curve, the mean site index is 148 for western hemlock and 138 for Douglas fir. On the basis of a 50-year site curve, it is 106 for western hemlock and 108 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 234 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 142 cubic feet per acre per year, occurring at age 70.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and establishment are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock or Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

239—Skykomish gravelly sandy loam, windswept, 0 to 30 percent slopes. This very deep, somewhat excessively drained soil is on terraces and escarpments. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 130 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. When mixed to a depth of 10 inches, the surface layer is dark brown

gravelly sandy loam. The upper 5 inches of the subsoil is yellowish red very gravelly sandy loam. The lower 9 inches is dark brown very gravelly loamy sand. The substratum to a depth of 60 inches is dark grayish brown and dark brown extremely gravelly coarse sand. The depth to extremely gravelly coarse sand ranges from 14 to 30 inches. In some areas the surface layer is very gravelly sandy loam or gravelly loam. In other areas the soil has a substratum of very gravelly sandy loam or has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Elwell, Olomount, Philippa, Rober, and Teneriffe soils, stony areas, and Skykomish soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Skykomish soil and very rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are western redcedar and red alder. The common forest understory plants are red huckleberry, western swordfern, western brackenfern, salal, and Oregongrape.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 120. On the basis of a 50-year site curve, it is estimated to be 85. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 180 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Douglas fir have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist and a moderate degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure

ground equipment can reduce the degree of compaction. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and establishment are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock or Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

240—Skykomish very stony loam, 0 to 30 percent slopes. This very deep, somewhat excessively drained soil is on terraces and escarpments. It formed in a mixture of volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 45 degrees F. The average frost-free period is about 130 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. The surface layer is dark brown very stony loam 5 inches thick. The upper 8 inches of the subsoil is dark reddish brown very stony loam. The lower 9 inches is yellowish red very stony sandy loam. The substratum to a depth of 60 inches is dark grayish brown extremely stony sand. The depth to extremely stony sand ranges from 14 to 30 inches. In some areas the surface layer is very stony sandy loam or stony loam. In other areas the soil has a substratum of very stony or very gravelly sandy loam or has 15 to 35 percent rock fragments in the subsoil and substratum.

Included in this unit are small areas of Elwell, Philippa, and Teneriffe soils and Skykomish soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Skykomish soil and very rapid in the substratum. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Douglas fir are the main woodland species. Among the trees of limited extent are western redcedar and red

alder. The common forest understory plants are red huckleberry, western swordfern, western brackenfern, salal, and Oregongrape.

On the basis of a 100-year site curve, the mean site index is 148 for western hemlock and 138 for Douglas fir. On the basis of a 50-year site curve, it is 106 for western hemlock and 108 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 234 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 142 cubic feet per acre per year, occurring at age 70.

The main limitations affecting timber harvesting are the surface stones and occasional snowpack. The stones on the surface hinder yarding. When felled, the timber can break on the stones. During an average year, snowpack limits the use of equipment and restricts access from January through March. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Logging loads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available. Cut and fill slopes tend to ravel when dry.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality and establishment are the main concerns affecting timber production. Reforestation can be accomplished by planting western hemlock or Douglas fir seedlings. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Because of the surface stones, planting seedlings by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVs.

241—Snoqualmie loamy fine sand, 0 to 8 percent slopes. This very deep, somewhat excessively drained soil is on river terraces. It formed in gravelly alluvium. The native vegetation is mainly trees and shrubs. Elevation is 800 to 1,700 feet. The average annual

precipitation is about 65 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 0.5 inch thick. The surface layer is very dark grayish brown loamy fine sand 8 inches thick. The upper 28 inches of the underlying material is very dark gray extremely gravelly coarse sand. The lower part to a depth of 60 inches is very dark gray extremely cobbly coarse sand. In some areas the surface layer is gravelly loamy sand, gravelly loam, or very gravelly sandy loam. In other areas the substratum has 15 to 35 percent rock fragments. In places the soil has strata of sandy loam.

Included in this unit are small areas of Greenwater and Pilchuck soils, Riverwash, poorly drained mineral or organic soils in drainageways, and Snoqualmie soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very rapid in the Snoqualmie soil. Available water capacity is low. The effective rooting depth is limited by an apparent high water table, which is at a depth of 3 to 5 feet from November through April. This soil is subject to occasional, brief periods of flooding from November through April. The flooding occurs during periods of snowmelt and rainfall. Runoff is very slow, and the hazard of water erosion is severe because of the susceptibility to flooding and channeling.

This unit is used as woodland or for wildlife habitat. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, western redcedar, and black cottonwood. The common forest understory plants are western swordfern, vine maple, red huckleberry, longtube twinflower, trailing blackberry, thimbleberry, deer fern, trillium, bunchberry dogwood, Oregongrape, salmonberry, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 143. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65.

The main hazard affecting timber harvesting is the flooding. Equipment should be used only during dry periods. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. The seedling survival rate may be low where flooding occurs. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIw.

242—Snoqualmie loamy fine sand, windswept, 0 to 8 percent slopes. This very deep, somewhat excessively drained soil is on river terraces. It formed in gravelly alluvium. The native vegetation is mainly trees and shrubs. Elevation is 800 to 1,700 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. The surface layer is very dark grayish brown loamy fine sand 8 inches thick. The upper 28 inches of the underlying material is very dark gray extremely gravelly coarse sand. The lower part to a depth of 60 inches is very dark gray extremely cobbly coarse sand. In some areas the surface layer is gravelly loamy sand, gravelly loam, or very gravelly sandy loam. In other areas the substratum has 15 to 35 percent rock fragments. In places the soil has strata of sandy loam.

Included in this unit are small areas of Greenwater and Pilchuck soils, Riverwash, poorly drained mineral or organic soils in drainageways, and Snoqualmie soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very rapid in the Snoqualmie soil. Available water capacity is low. The effective rooting depth is limited by an apparent high water table, which is at a depth of 3 to 5 feet from November through April. This soil is subject to occasional, brief periods of flooding from November through April. The flooding occurs during periods of snowmelt and rainfall. Runoff is very slow, and the hazard of water erosion is severe because of the susceptibility to flooding and channeling.

This unit is used as woodland or for wildlife habitat. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, western redcedar, and black cottonwood. The common forest understory plants are western swordfern, vine maple, red huckleberry, longtube twinflower, trailing

blackberry, thimbleberry, deer fern, trillium, bunchberry dogwood, Oregongrape, salmonberry, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 110. On the basis of a 50-year site curve, it is estimated to be 85. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 98 cubic feet per acre per year, occurring at age 60. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main hazard affecting timber harvesting is the flooding. Equipment should be used only during dry periods. Logging roads require suitable surfacing for year-round use. Rounded pebbles and cobbles for road construction are readily available.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. The seedling survival rate may be low where flooding occurs. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIw.

243—Spukwush loamy sand, 8 to 30 percent slopes. This very deep, well drained soil is in slump areas in the mountains. It formed in volcanic ash and cinders over highly weathered tuffaceous material. The native vegetation is mainly conifers and shrubs. Elevation is 2,700 to 4,000 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 120 days.

When mixed to a depth of 7 inches, the surface layer is strong brown loamy sand. The upper 8 inches of the subsoil is brown very cindery sandy loam. The lower 21 inches is yellowish brown and light yellowish brown loam. The upper 3 inches of the substratum is light yellowish brown loam. The lower part to a depth of 60 inches is light yellowish brown gravelly loam. In some

areas the surface layer is sandy loam. In other areas the soil has 25 to 60 percent rock fragments in the lower part of the substratum.

Included in this unit are small areas of Haywire, Nagrom, and Playco soils and Spukwush soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Spukwush soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is Douglas fir. The common forest understory plants are huckleberry, devilclub, deer fern, evergreen huckleberry, currant, Oregongrape, western swordfern, western brackenfern, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 123. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 186 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from

unmanaged fires in undisturbed areas.

Seedling mortality and establishment are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock, Pacific silver fir, or Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of western hemlock seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIe.

244—Stahl very gravelly silt loam, 30 to 65 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and colluvium and residuum derived dominantly from andesite. The native vegetation is mainly conifers and shrubs. Elevation is 2,700 to 4,700 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 4 inches thick. The surface layer is dark brown very gravelly silt loam 8 inches thick. The subsoil also is dark brown very gravelly silt loam. It is 7 inches thick. The substratum is dark brown extremely cobbly silty clay loam 14 inches thick. Andesite is at a depth of about 29 inches. The depth to andesite ranges from 20 to 40 inches. In some areas the surface layer is gravelly silt loam. In other areas the soil is 40 to 60 inches deep over bedrock or is underlain by breccia.

Included in this unit are small areas of Nagrom, Reichel, and Spukwush soils and Stahl soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Stahl soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and western redcedar. The common forest understory plants are Oregongrape, bunchberry dogwood, queencup beadlily, red huckleberry, violet, Pacific

trillium, western rattlesnake plantain, salal, common beargrass, western swordfern, American trailplant, western brackenfern, vine maple, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index is 130 for western hemlock and 124 for Douglas fir. On the basis of a 50-year site curve, it is 91 for western hemlock and 95 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 200 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 121 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is readily available. Cut and fill slopes tend to slump when wet.

Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock, Douglas fir, noble fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of western hemlock seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are

occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass Vile.

245—Stahl very gravelly silt loam, tuff substratum, 15 to 30 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and colluvium and residuum derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 2,700 to 4,700 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 8 inches thick. The surface layer is very dark brown very gravelly silt loam 7 inches thick. The upper 10 inches of the subsoil is dark brown very gravelly silt loam. The lower 18 inches is dark brown extremely gravelly silt loam. Breccia is at a depth of about 35 inches. The depth to breccia or tuff ranges from 20 to 40 inches. In some areas the surface layer is gravelly silt loam. In other areas the soil is 40 to 60 inches deep over bedrock or is underlain by andesite.

Included in this unit are small areas of Nagrom, Reichel, and Spukwush soils and Stahl soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Stahl soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and western redcedar. The common forest understory plants are Oregon grape, bunchberry dogwood, queencup beadlily, red huckleberry, violet, Pacific trillium, western rattlesnake plantain, salal, common beargrass, western swordfern, American trailplant, western brackenfern, vine maple, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index is 130 for western hemlock and 124 for Douglas fir. On the basis of a 50-year site curve, it is 91 for western hemlock and 95 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 200 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 121 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the hazard of erosion. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock, Douglas fir, noble fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of western hemlock seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIe.

246—Stahl very gravelly silt loam, tuff substratum, 30 to 65 percent slopes. This well drained soil is on mountain back slopes. It is moderately deep to bedrock. It formed in a mixture of volcanic ash and colluvium and residuum derived dominantly from breccia and tuff. The native vegetation is mainly conifers and shrubs. Elevation is 2,700 to 4,700 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of

decomposed needles, leaves, and twigs 8 inches thick. The surface layer is very dark brown very gravelly silt loam 7 inches thick. The upper 10 inches of the subsoil is dark brown very gravelly silt loam. The lower 18 inches is dark brown extremely gravelly silt loam. Breccia is at a depth of about 35 inches. The depth to breccia or tuff ranges from 20 to 40 inches. In some areas the surface layer is gravelly silt loam. In other areas the soil is 40 to 60 inches deep over bedrock or is underlain by andesite.

Included in this unit are small areas of Nagrom, Reichel, and Spukwush soils and Stahl soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Stahl soil. Available water capacity also is moderate. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock, Douglas fir, and Pacific silver fir are the main woodland species. Among the trees of limited extent are noble fir and western redcedar. The common forest understory plants are Oregon grape, bunchberry dogwood, queencup beadlily, red huckleberry, violet, Pacific trillium, western rattlesnake plantain, salal, common beargrass, western swordfern, American trailplant, western brackenfern, vine maple, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index is 130 for western hemlock and 124 for Douglas fir. On the basis of a 50-year site curve, it is 91 for western hemlock and 95 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is 200 cubic feet per acre per year, occurring at age 50. For Douglas fir it is 121 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality breccia or tuff. Extra rock is needed to maintain a stable

and uniform road surface. Cut and fill slopes tend to slump when wet. Roads and cut and fill slopes are subject to failure as a result of the instability of the underlying tuff or breccia.

Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling mortality, seedling establishment, and the hazard of windthrow are the main concerns affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock, Douglas fir, noble fir, or Pacific silver fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of western hemlock seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the bedrock, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

247—Sulsavar loam, 0 to 8 percent slopes. This very deep, well drained soil is on alluvial fans and terraces. It formed in volcanic ash and alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 1,100 to 1,500 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and moss 2 inches thick. The surface layer is dark brown loam 28 inches thick. The subsoil is yellowish brown sandy loam 19 inches thick. The upper 4 inches of the substratum is dark yellowish brown and yellowish brown loam. The lower part to a depth of 60 inches is dark brown and dark yellowish brown very gravelly loam. In some areas the surface layer is silt loam or sandy loam.

Included in this unit are small areas of Klaus and Winston soils, soils that are very gravelly sand in the lower part of the substratum, and Sulsavar soils that have slopes of more than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Sulsavar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to rare flooding.

This unit is used mainly as woodland. It also is used as hayland, pasture, or cropland.

In the areas used for hay and pasture, the main hazard is the flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and help to control runoff and erosion.

The main hazard in the areas used as cropland is the flooding. This unit is suited to all of the crops commonly grown in the survey area. The principal crops are oats and corn silage. In summer, irrigation is required for maximum production.

Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder and western redcedar. The common forest understory plants are western swordfern, red huckleberry, vine maple, ladyfern, trailing blackberry, salal, and Oregongrape.

On the basis of a 100-year site curve, the mean site index is 183 for Douglas fir and 178 for western hemlock. On the basis of a 50-year site curve, it is 142 for Douglas fir and 124 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 194 cubic feet per acre per year, occurring at age 60. For western hemlock it is 288 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and

gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of Douglas fir seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIe.

248—Sultan silt loam, 0 to 2 percent slopes. This very deep, moderately well drained soil is on river terraces. It formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 50 to 120 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 175 days.

Typically, the surface layer is very dark grayish brown silt loam 9 inches thick. The upper 15 inches of the subsoil is yellowish brown silty clay loam and light olive brown silt loam. The lower 24 inches is grayish brown, mottled silty clay loam. The substratum to a depth of 60 inches is olive gray, mottled very fine sandy loam stratified with sand. In some areas the surface layer is very fine sandy loam. In other areas the soil has sand at a depth of 40 to 60 inches.

Included in this unit are small areas of Belfast, Nooksack, Puget, and Woodinville soils and Sultan soils that have slopes of more than 2 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Sultan soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at a depth of 2 to 4 feet from November through April. Runoff is very slow, and there is no hazard of erosion. This soil is subject to rare flooding.

This unit is used mainly as hayland, pasture, or cropland. It also is used as a site for homes.

In the areas used for hay and pasture, the main limitation is the seasonal high water table. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and help to control runoff and erosion.

The main limitation in the areas used as cropland is the seasonal high water table. This unit is suited to all of the crops commonly grown in the survey area. The

principal crops are oats and corn silage. In summer, irrigation is required for maximum production.

Douglas fir and red alder are the main woodland species. Among the trees of limited extent is western redcedar. The common forest understory plants are vine maple, willows, western swordfern, salmonberry, Oregon grape, thimbleberry, stinging nettle, bedstraw, western brackenfern, trailing blackberry, and trillium.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 160. On the basis of a 40-year site curve, it is estimated to be 120. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 170 cubic feet per acre per year, occurring at age 65.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, red alder, or western redcedar seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

In the areas used for homesite development, the main limitations are the flooding and the seasonal high water table. The seasonal high water table increases the likelihood that septic tank absorption fields will fail. Installing the absorption field in fill approved by the health district helps to overcome these limitations.

This unit is in capability subclass IIw.

249—Teneriffe loamy sand, 8 to 30 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice over

colluvium derived dominantly from granite and low-grade metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark brown loamy sand. The upper 4 inches of the subsoil also is dark brown loamy sand. The next 10 inches is strong brown gravelly loamy sand. The lower 16 inches is olive brown and light olive brown very gravelly loamy sand. The substratum to a depth of 60 inches is light yellowish brown very gravelly coarse sand. In some areas the surface layer is sandy loam. In other areas the soil is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Marblemount and Philippa soils and Teneriffe soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid in the Teneriffe soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are vine maple, salal, Oregongrape, western swordfern, red huckleberry, western brackenfern, trailing blackberry, longtube twinflower, queencup beadlily, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 143. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced

roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs periodically.

This unit is in capability subclass IVe.

250—Teneriffe loamy sand, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice over colluvium derived dominantly from granite and low-grade metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark brown loamy sand. The upper 4 inches of the subsoil also is dark brown loamy sand. The next 10 inches is strong brown gravelly loamy sand. The lower 16 inches is olive brown and light olive brown very gravelly loamy sand. The substratum to a depth of 60 inches is light yellowish brown very gravelly coarse sand. In some areas the surface layer is sandy loam. In other areas the soil is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Marblemount and Philippa soils and Teneriffe soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid in the Teneriffe soil. Available water capacity is low. The effective rooting depth is 60

inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are vine maple, salal, Oregon grape, western swordfern, red huckleberry, western brackenfern, trailing blackberry, longtube twinflower, queencup beadlily, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 143. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs periodically.

This unit is in capability subclass VIIe.

251—Teneriffe loamy sand, windswept, 30 to 65 percent slopes. This deep and very deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice over colluvium derived dominantly from granite and low-grade metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 3 inches thick. When mixed to a depth of 7 inches, the surface layer is dark brown loamy sand. The upper 4 inches of the subsoil also is dark brown loamy sand. The next 10 inches is strong brown gravelly loamy sand. The lower 16 inches is olive brown and light olive brown very gravelly loamy sand. The substratum to a depth of 60 inches is light yellowish brown very gravelly coarse sand. In some areas the surface layer is sandy loam. In other areas the soil is 40 to 60 inches deep over bedrock.

Included in this unit are small areas of Marblemount and Philippa soils and Teneriffe soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid in the Teneriffe soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are vine maple, salal, Oregon grape, western swordfern, red huckleberry, western brackenfern, trailing blackberry, longtube twinflower, queencup beadlily, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 117. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope

restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality granite. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs periodically.

This unit is in capability subclass VIIe.

252—Teneriffe very gravelly sandy loam, channery substratum, 8 to 30 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice over colluvium derived dominantly from low-grade metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown very gravelly sandy loam. The subsoil is yellowish brown very gravelly loamy sand 5 inches thick. The substratum is light yellowish brown extremely channery loamy sand 36 inches thick. Weathered shale is at a depth of about 47 inches. The depth to shale, phyllite, or slate ranges from 40 to 60 inches. In some areas the surface layer is gravelly sandy loam or very gravelly loamy sand. In other areas the soil is more than 60 inches deep over bedrock.

Included in this unit are small areas of Marblemount and Philippa soils and Teneriffe soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid in the Teneriffe soil. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are vine maple, salal, Oregongrape, western swordfern, red huckleberry, western brackenfern, trailing blackberry, longtube twinflower, queencup beadlily, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 143. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality shale, phyllite, and slate. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the

survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs periodically.

This unit is in capability subclass IVe.

253—Teneriffe very gravelly sandy loam, channery substratum, 30 to 65 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in volcanic ash and pumice over colluvium derived dominantly from low-grade metamorphic rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 110 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, twigs, and moss 3 inches thick. When mixed to a depth of 6 inches, the surface layer is dark brown very gravelly sandy loam. The subsoil is yellowish brown very gravelly loamy sand 5 inches thick. The substratum is light yellowish brown extremely channery loamy sand 36 inches thick. Weathered shale is at a depth of about 47 inches. The depth to shale, phyllite, or slate ranges from 40 to 60 inches. In some areas the surface layer is gravelly sandy loam or very gravelly loamy sand. In other areas the soil is more than 60 inches deep over bedrock.

Included in this unit are small areas of Marblemount and Philippa soils and Teneriffe soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is rapid in the Teneriffe soil. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are vine maple, salal, Oregon grape, western swordfern, red huckleberry, western brackenfern, trailing blackberry, longtube twinflower, queencup beadlily, and deer fern.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 143. On the basis of a 50-year site curve, it is 110. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 149 cubic feet per acre per year, occurring at age 65. Estimates of the site index and growth rate of western hemlock have not been made.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality shale, phyllite, and slate. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs periodically.

This unit is in capability subclass VIIe.

254—Tokul gravelly loam, 0 to 6 percent slopes. This moderately well drained soil is on mountain foot slopes and in valleys. It is moderately deep to ortstein. It formed in a mixture of volcanic ash and dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,100 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 0.5 inch thick. The surface layer is very dark brown gravelly loam 3 inches thick. The subsoil is dark yellowish brown gravelly loam 28 inches thick. The substratum is dark yellowish brown gravelly fine sandy loam 6 inches thick. Dark grayish

brown ortstein that crushes to very gravelly sandy loam is at a depth of about 37 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loam, silt loam, or gravelly silt loam. In other areas the soil has 35 to 45 percent rock fragments in the subsoil or is 40 to 60 inches deep to ortstein.

Included in this unit are small areas of Barneston, Beausite, Norma, and Pastik soils and Tokul soils that have slopes of more than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Tokul soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used for hay and pasture.

In the areas used for hay and pasture, the main limitations are the seasonal high water and the hazard of erosion. Proper stocking rates, pasture rotation, and restricted grazing during short wet periods help to keep the pasture in good condition and help to control runoff and erosion. The wetness can be reduced in some areas by diversions, which intercept water, and by open ditches, which remove excess water.

Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar, red alder, and bigleaf maple. The common forest understory plants are western swordfern, western brackenfern, red huckleberry, salal, trailing blackberry, salmonberry, vine maple, deer fern, ladyfern, Oregongrape, and Pacific trillium.

On the basis of a 100-year site curve, the mean site index is 172 for Douglas fir and 166 for western hemlock. On the basis of a 50-year site curve, it is 130 for Douglas fir and 117 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 183 cubic feet per acre per year, occurring at age 60. For western hemlock it is 266 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their

use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IIIe.

255—Tokul gravelly loam, 6 to 15 percent slopes.

This moderately well drained soil is on mountain foot slopes and in valleys. It is moderately deep to ortstein. It formed in a mixture of volcanic ash and dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,100 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 0.5 inch thick. The surface layer is very dark brown gravelly loam 3 inches thick. The subsoil is dark yellowish brown gravelly loam 28 inches thick. The substratum is dark yellowish brown gravelly fine sandy loam 6 inches thick. Dark grayish brown ortstein that crushes to very gravelly sandy loam is at a depth of about 37 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loam, silt loam, or gravelly silt loam. In other areas the soil has 35 to 45 percent rock fragments in the subsoil or is 40 to 60 inches deep to ortstein.

Included in this unit are small areas of Barneston, Beausite, Norma, and Pastik soils and Tokul soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Tokul soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through May. In most areas, runoff is slow

and the hazard of water erosion is slight. In areas used as pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used mainly as woodland. It also is used for hay and pasture.

In the areas used for hay and pasture, the main limitations are the seasonal high water and the hazard of erosion. Proper stocking rates, pasture rotation, and restricted grazing during short wet periods help to keep the pasture in good condition and help to control runoff and erosion. The wetness can be reduced in some areas by diversions, which intercept water, and by open ditches, which remove excess water.

Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar, red alder, and bigleaf maple. The common forest understory plants are western swordfern, western brackenfern, red huckleberry, salal, trailing blackberry, salmonberry, vine maple, deer fern, ladyfern, Oregongrape, and Pacific trillium.

On the basis of a 100-year site curve, the mean site index is 172 for Douglas fir and 166 for western hemlock. On the basis of a 50-year site curve, it is 130 for Douglas fir and 117 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 183 cubic feet per acre per year, occurring at age 60. For western hemlock it is 266 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy,

the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IIIe.

256—Tokul gravelly loam, 15 to 30 percent slopes.

This moderately well drained soil is mountain foot slopes and in valleys. It is moderately deep to ortstein. It formed in a mixture of volcanic ash and dense glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,100 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 0.5 inch thick. The surface layer is very dark brown gravelly loam 3 inches thick. The subsoil is dark yellowish brown gravelly loam 28 inches thick. The substratum is dark yellowish brown gravelly fine sandy loam 6 inches thick. Dark grayish brown ortstein that crushes to very gravelly sandy loam is at a depth of about 37 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loam, silt loam, or gravelly silt loam. In other areas the soil has 35 to 45 percent rock fragments in the subsoil or is 40 to 60 inches deep to ortstein.

Included in this unit are small areas of Barneston, Beausite, Norma, and Pastik soils and Tokul soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Tokul soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar, red alder, and bigleaf maple. The common forest understory plants are western swordfern, western brackenfern, red huckleberry, salal, trailing blackberry, salmonberry, vine maple, deer fern, ladyfern, Oregongrape, and Pacific trillium.

On the basis of a 100-year site curve, the mean site index is 172 for Douglas fir and 166 for western hemlock. On the basis of a 50-year site curve, it is 130 for Douglas fir and 117 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 183 cubic feet per acre per

year, occurring at age 60. For western hemlock it is 266 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IVe.

257—Tokul gravelly loam, 30 to 65 percent slopes.

This moderately well drained soil is on mountain foot slopes and in valleys. It is moderately deep to ortstein. It formed in a mixture of volcanic ash and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,100 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 0.5 inch thick. The surface layer is very dark brown gravelly loam 3 inches thick. The subsoil is dark yellowish brown gravelly loam 28 inches thick. The substratum is dark yellowish brown gravelly fine sandy loam 6 inches thick. Dark grayish brown ortstein that crushes to very gravelly sandy loam is below a depth of about 37 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the

surface layer is loam, silt loam, or gravelly silt loam. In other areas the soil has 35 to 45 percent rock fragments in the subsoil or is 40 to 60 inches deep to ortstein.

Included in this unit are small areas of Barneston, Beausite, and Pastik soils and Tokul soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the upper part of the Tokul soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through May. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are western redcedar, red alder, and bigleaf maple. The common forest understory plants are western swordfern, western brackenfern, red huckleberry, salal, trailing blackberry, salmonberry, vine maple, deer fern, ladyfern, Oregon grape, and Pacific trillium.

On the basis of a 100-year site curve, the mean site index is 172 for Douglas fir and 166 for western hemlock. On the basis of a 50-year site curve, it is 130 for Douglas fir and 117 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 183 cubic feet per acre per year, occurring at age 60. For western hemlock it is 266 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Rock for road construction is not readily available. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the ortstein, trees are occasionally subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass VIIe.

258—Tokul-Pastik complex, 45 to 90 percent slopes. This map unit is on terrace escarpments and mountain foot slopes. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,100 feet. The average annual precipitation is about 65 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 160 days.

This unit is 50 percent Tokul gravelly loam and 25 percent Pastik silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Barneston and Nargar soils and Tokul and Pastik soils that have slopes of less than 45 percent. Included areas make up about 25 percent of the total acreage.

The Tokul soil is moderately deep to ortstein and is moderately well drained. It formed in a mixture of volcanic ash and dense glacial till. Typically, the surface is covered with a mat of needles, leaves, and twigs 0.5 inch thick. The surface layer is very dark brown gravelly loam 3 inches thick. The subsoil is dark yellowish brown gravelly loam 28 inches thick. The substratum is dark yellowish brown gravelly fine sandy loam 6 inches thick. Dark grayish brown ortstein that crushes to very gravelly sandy loam is at a depth of about 37 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loam, silt loam, or gravelly silt loam. In other areas the soil has 35 to 45 percent rock fragments in the subsoil or is 40 to 60 inches deep to ortstein.

Permeability is moderate in the upper part of the Tokul soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through May. Runoff is rapid, and the hazard of water erosion is severe.

The Pastik soil is very deep and moderately well drained. It formed in lake sediments and volcanic ash. Typically, the surface is covered with a mat of needles,

leaves, and twigs 2 inches thick. The surface layer is dark brown silt loam 6 inches thick. The upper 6 inches of the subsoil also is dark brown silt loam. The lower 19 inches is dark yellowish brown and yellowish brown very fine sandy loam. The substratum to a depth of 60 inches is olive brown and light brownish gray silt loam. In some areas the surface layer is sandy loam or loam. In other areas the substratum is silty clay.

Permeability is slow in the Pastik soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a depth of 1.5 to 2.5 feet from December through May. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, red huckleberry, ladyfern, vine maple, salal, deer fern, salmonberry, western brackenfern, trailing blackberry, ladyfern, Pacific trillium, and Oregongrape.

On the basis of a 100-year site curve, the mean site index on the Tokul soil is 172 for Douglas fir and 166 for western hemlock. On the basis of a 50-year site curve, it is 130 for Douglas fir and 117 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 183 cubic feet per acre per year, occurring at age 60. For western hemlock it is 266 cubic feet per acre per year, occurring at age 50.

On the basis of a 100-year site curve, the mean site index on the Pastik soil is 177 for Douglas fir and 176 for western hemlock. On the basis of a 50-year site curve, it is 132 for Douglas fir and 123 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 188 cubic feet per acre per year, occurring at age 60. For western hemlock it is 285 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and

filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a high degree of soil compaction when the soils are moist and a high degree of puddling when the soils are wet. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are occasionally subject to windthrow when the soils are wet and winds are strong.

The Tokul and Pastik soils are in capability subclass VIIe.

259—Tokul-Pastik complex, windswept, 45 to 90 percent slopes. This map unit is on terrace escarpments and mountain foot slopes. The native vegetation is mainly conifers and shrubs. Elevation is 800 to 1,100 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

This unit is 50 percent Tokul gravelly loam and 25 percent Pastik silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Barneston and Nargar soils and Tokul and Pastik soils that have slopes of less than 45 percent. Included areas make up about 25 percent of the total acreage.

The Tokul soil is moderately deep to ortstein and is moderately well drained. It formed in a mixture of volcanic ash and dense glacial till. Typically, the surface is covered with a mat of needles, leaves, and twigs 0.5 inch thick. The surface layer is very dark brown gravelly loam 3 inches thick. The subsoil is dark yellowish brown

gravelly loam 28 inches thick. The substratum is dark yellowish brown gravelly fine sandy loam 6 inches thick. Dark grayish brown ortstein that crushes to very gravelly sandy loam is at a depth of about 37 inches. The depth to ortstein ranges from 20 to 40 inches. In some areas the surface layer is loam, silt loam, or gravelly silt loam. In other areas the soil has 35 to 45 percent rock fragments in the subsoil or is 40 to 60 inches deep to ortstein.

Permeability is moderate in the upper part of the Tokul soil and very slow in the ortstein. Available water capacity is moderate. The effective rooting depth is 20 to 40 inches. Water is perched above the ortstein from November through May. Runoff is rapid, and the hazard of water erosion is severe.

The Pastik soil is very deep and moderately well drained. It formed in lake sediments and volcanic ash. Typically, the surface is covered with a mat of needles, leaves, and twigs 2 inches thick. The surface layer is dark brown silt loam 6 inches thick. The upper 6 inches of the subsoil also is dark brown silt loam. The lower 19 inches is dark yellowish brown and yellowish brown very fine sandy loam. The substratum to a depth of 60 inches is olive brown and light brownish gray very fine sandy loam. In some areas the surface layer is sandy loam or loam. In other areas the substratum is silty clay.

Permeability is slow in the Pastik soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table, which is at a depth of 1.5 to 2.5 feet from December through May. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, red huckleberry, ladyfern, vine maple, salal, deer fern, salmonberry, western brackenfern, trailing blackberry, ladyfern, Pacific trillium, and Oregongrape.

On the basis of a 100-year site curve, the mean site index on both soils for Douglas fir is estimated to be 137. On the basis of a 50-year site curve, it is estimated to be 105. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 140 cubic feet per acre per year, occurring at age 70. Estimates of the site index and growth rate of western hemlock have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems

generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a high degree of soil compaction when the soils are moist and a high degree of puddling when the soils are wet. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are occasionally subject to windthrow when the soils are wet and winds are strong.

This unit is in capability subclass VIIe.

260—Treen loam, 30 to 90 percent slopes. This well drained soil is on mountain back slopes and ridge crests. It is shallow to bedrock. It formed in a mixture of volcanic ash and material weathered from various rock types. The native vegetation is mainly forbs. Elevation is 3,200 to 5,000 feet. The average annual precipitation is about 100 inches, and the average annual air temperature is about 40 degrees F. The average frost-free period is about 90 days.

Typically, the surface is covered with a mat of organic material 2 inches thick. The upper 5 inches of the surface layer is very dark grayish brown loam. The

lower 9 inches is dark brown sandy loam. The subsoil is brown gravelly sandy loam 4 inches thick. Schist is at a depth of about 18 inches. The depth to bedrock ranges from 14 to 20 inches. In some areas the surface layer is sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the lower part of the subsoil and in the substratum.

Included in this unit are small areas of Haywire soils, avalanche chutes, and Treen soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Treen soil. Available water capacity is low. The effective rooting depth is 14 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for wildlife habitat.

This unit is in capability subclass VIIe.

261—Tukwila muck, 0 to 1 percent slopes. This very deep, very poorly drained soil is in depressions on stream terraces. It formed in herbaceous and woody organic deposits stratified with mineral layers. The native vegetation is mainly shrubs, forbs, and trees. Elevation is 100 to 500 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 170 days.

Typically, the surface layer is black muck 10 inches thick. The upper 31 inches of the underlying material is black and dark reddish brown sapric material. The lower part to a depth of 60 inches is dark brown, dark reddish brown, and gray, stratified mineral and sapric material. In some areas the surface layer is hemic material. In other areas the lower part of the underlying material is all mineral or all sapric material.

Included in this unit are small areas of Norma and Woodinville soils, ponded areas, and drained Tukwila soils. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Tukwila soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at or above the surface or within a depth of 1 foot from October through May. Runoff is very slow, and there is no hazard of erosion.

This unit is used mainly for wildlife habitat. It also is used as woodland. Drained areas are used for hay and pasture.

In the areas used for hay and pasture, the main limitations are the high water table and low strength. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Grazing when the soil is wet results in compaction of the surface layer and poor tilth.

Red alder is the main woodland species. Among the trees of limited extent are western redcedar, western hemlock, and Sitka spruce. The common forest understory plants are western swordfern, devilsclub, vine maple, sedges, and rushes.

On the basis of a 50-year site curve, the mean site index for red alder is estimated to be 85. The highest average growth rate in unmanaged, even-aged stands of red alder is about 92 cubic feet per acre per year, occurring at age 40.

The main limitations affecting timber harvesting are the seasonal high water table and low strength. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seeding establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass Vw.

262—Tusip sandy loam, 15 to 30 percent slopes.

This deep, well drained soil is on mountain back slopes and rounded ridgetops. It formed in volcanic ash, pumice, and cinders over residuum and colluvium derived from weathered sandstone. The native vegetation is mainly conifers and shrubs. Elevation is 2,700 to 3,600 feet. The average annual precipitation is about 90 inches, and the average annual air

temperature is about 42 degrees F. The average frost-free period is about 130 days.

Typically, the surface is covered with a mat of needles, leaves, bark, and moss 1 inch thick. When mixed to a depth of 6 inches, the surface layer is dark brown sandy loam. The upper 9 inches of the subsoil is strong brown loamy sand. The next 23 inches is yellowish brown gravelly sandy loam and gravelly fine sandy loam. The lower 5 inches is yellowish brown very gravelly fine sandy loam. Weathered sandstone is at a depth of about 43 inches. The depth to weathered sandstone ranges from 40 to 60 inches. In some areas the surface layer is cindery loam or cindery sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the substratum or is more than 60 inches deep to sandstone.

Included in this unit are small areas of Cattcreek, Cotteral, Nagrom, and Playco soils and Tusip soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Tusip soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is Douglas fir. The common forest understory plants are salal, tall blue huckleberry, deer fern, western swordfern, common beargrass, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 123. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 186 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made. Areas on ridgetops that are subject to strong, persistent winds are less productive than the other areas of this unit.

The main limitation affecting timber harvesting is snowpack. During an average year, snowpack limits the use of equipment and restricts access from November through April. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is

poor-quality sandstone. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion. Cinders readily slough from cuts onto the road surface.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit.

This unit is in capability subclass VIe.

263—Tusip sandy loam, 30 to 65 percent slopes.

This deep, well drained soil is on mountain back slopes. It formed in volcanic ash, pumice, and cinders over residuum and colluvium derived from weathered sandstone. The native vegetation is mainly conifers and shrubs. Elevation is 2,700 to 3,600 feet. The average annual precipitation is about 90 inches, and the average annual air temperature is about 42 degrees F. The average frost-free period is about 120 days.

Typically, the surface is covered with a mat of needles, leaves, bark, and moss 1 inch thick. When mixed to a depth of 6 inches, the surface layer is dark brown sandy loam. The upper 9 inches of the subsoil is strong brown loamy sand. The next 23 inches is yellowish brown gravelly sandy loam and gravelly fine sandy loam. The lower 5 inches is yellowish brown very gravelly fine sandy loam. Weathered sandstone is at a depth of about 43 inches. The depth to weathered sandstone ranges from 40 to 60 inches. In some areas the surface layer is cindery loam or cindery sandy loam. In other areas the soil has 15 to 35 percent rock fragments in the substratum or is more than 60 inches deep to sandstone.

Included in this unit are small areas of Cattcreek,

Cotteral, Nagrom, and Playco soils and Tusip soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Tusip soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Western hemlock and Pacific silver fir are the main woodland species. Among the trees of limited extent is Douglas fir. The common forest understory plants are salal, tall blue huckleberry, deer fern, western swordfern, common beargrass, and longtube twinflower.

On the basis of a 100-year site curve, the mean site index for western hemlock is estimated to be 123. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 186 cubic feet per acre per year, occurring at age 50. Estimates of the site index and growth rate of Pacific silver fir have not been made.

The main limitations affecting timber harvesting are the slope, snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from November through April. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to ravel when dry. Establishing a plant cover in these disturbed areas reduces the hazard of erosion.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soil is moist, a moderate degree of puddling when the soil is wet, and a moderate degree of soil displacement when the soil is dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality is the main concern affecting timber production. A low soil temperature, deep snowpack, and a short growing season hinder the survival of planted and naturally occurring seedlings and delay their establishment. Reforestation can be accomplished by planting western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and Pacific silver fir occurs periodically.

This unit is in capability subclass VIIe.

264—Typic Haplorthods, 35 to 100 percent slopes.

These moderately deep and deep, well drained soils are on mountainsides and canyonsides. They formed in volcanic ash, glacial drift, and colluvium. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 2,500 feet. The average annual precipitation is about 65 inches, the average annual air temperature is about 47 degrees F, and the average annual soil temperature ranges from 45 to 49 degrees F. The average frost-free period is about 140 days.

No single profile is representative of these soils. One of the more commonly observed ones, however, is covered with a mat of leaves and twigs about 2 inches thick. Typically, the surface layer is very dark grayish brown very gravelly loam 3 inches thick. The upper 19 inches of the subsoil is dark brown very gravelly loam. The lower 10 inches is olive brown very gravelly loam. The substratum is dark brown and light olive brown very gravelly loam. Grayish brown, dense glacial till that crushes to extremely gravelly loamy sand is at a depth of about 45 inches. The dense glacial till is similar to a cemented pan. The depth to dense glacial till or bedrock ranges from 20 to 60 inches. The content of clay ranges from 5 to 20 percent.

Included in this unit are small areas of Alderwood, Barneston, Elwell, Littlejohn, Lynnwood, Ovall, and Pitcher soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Typic Haplorthods. Available water capacity also is moderate. The effective rooting depth is more than 20 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are bigleaf maple and western redcedar. The common forest understory plants are western swordfern, Oregon grape, red huckleberry, and salal.

On the basis of a 100-year site curve, the mean site index is estimated to be 149 for Douglas fir and 150 for western hemlock. On the basis of a 50-year site curve,

it is estimated to be 115 for Douglas fir and 105 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 151 cubic feet per acre per year, occurring at age 60. For western hemlock it is 238 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are occasional snowpack, the slope, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. During an average year, snowpack limits the use of equipment and restricts access in January and February. Unsurfaced roads are slippery and soft when wet and are subject to deep rutting during rainy periods. Rock for road construction is generally not readily available. Cut and fill slopes tend to slump when wet. Following road construction and clearcutting, road failures and landslides are likely to occur. The areas most susceptible to landslides are those underlain by dense glacial till. Locating roads on midslopes requires extensive cutting and filling, which remove land from production. Soil creep is common on this unit.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soils are moist, a moderate degree of puddling when the soils are wet, and a moderate degree of soil displacement when the soils are dry. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction, puddling, and displacement and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling mortality and establishment are the main concerns affecting timber production. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. Because of the slope, planting by hand is difficult. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of

seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

265—Typic Udifluvents, 0 to 3 percent slopes.

These very deep, well drained soils are on low stream terraces and in drainageways. They formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 2,500 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 150 days.

No single profile is representative of these soils. One of the more commonly observed ones, however, is covered with a mat of needles, leaves, and twigs 0.5 inch thick. Typically, the surface layer is very dark brown silt loam 5 inches thick. The subsoil is dark yellowish brown silt loam 11 inches thick. The substratum to a depth of 60 inches is dark yellowish brown, stratified fine sandy loam and sandy loam. The depth to stratified, loamy or sandy material ranges from 15 to 50 inches. In some areas the surface layer is very fine sandy loam.

Included in this unit are small areas of soils that are similar to the Typic Udifluvents but are more poorly drained, organic soils, and Typic Udifluvents that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Typic Udifluvents. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is very slow, and there is no hazard of erosion. These soils are subject to frequent, brief periods of flooding from December through April.

This unit is used mainly as woodland. In some areas it is used as hayland or pasture.

This unit is well suited to hay and pasture. The main hazard is the occasional flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and help to control runoff and erosion. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are vine maple, willows, western swordfern, salmonberry, Oregongrape, thimbleberry, stinging nettle, bedstraw, western brackenfern, trailing blackberry, and trillium.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 167. On the basis of a 50-year site curve, it is estimated to be 125. The highest average growth rate in unmanaged, even-

aged stands of Douglas fir is about 178 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are the muddiness caused by seasonal wetness and the flooding. The use of wheeled and tracked equipment when the soils are wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soils. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soils are moist, a high degree of puddling when the soils are wet, and a moderate degree of soil displacement when the soils are dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. The occasional flooding hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVw.

266—Typic Udifluvents, windswept, 0 to 3 percent slopes. These very deep, well drained soils are on low stream terraces and in drainageways. They formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 2,500 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 46 degrees F. The average frost-free period is about 150 days.

No single profile is representative of these soils. One of the more commonly observed ones, however, is covered with a mat of needles, leaves, and twigs 0.5 inch thick. Typically, the surface layer is very dark brown silt loam 5 inches thick. The subsoil is dark yellowish brown silt loam 11 inches thick. The substratum to a depth of 60 inches is dark yellowish brown, stratified fine sandy loam and sandy loam. The depth to stratified, loamy or sandy material ranges from 15 to 50 inches. In some areas the surface layer is very fine sandy loam.

Included in this unit are small areas of soils that are similar to the Typic Udifluvents but are more poorly drained, organic soils, and Typic Udifluvents that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Typic Udifluvents. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is very slow, and there is no hazard of erosion. These soils are subject to frequent, brief periods of flooding from December through April.

This unit is used mainly as woodland. In some areas it is used as hayland or pasture.

This unit is well suited to hay and pasture. The main hazard is the occasional flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and help to control runoff and erosion. In summer, irrigation is required for maximum production.

Douglas fir is the main woodland species. Among the trees of limited extent are western hemlock, western redcedar, and red alder. The common forest understory plants are vine maple, willows, western swordfern, salmonberry, Oregongrape, thimbleberry, stinging nettle, bedstraw, western brackenfern, trailing blackberry, and trillium.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 118. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 111 cubic feet per acre per year, occurring at age 60. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitations affecting timber harvesting are the muddiness caused by seasonal wetness and the flooding. The use of wheeled and tracked equipment when the soils are wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soils. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soils are moist, a high degree of puddling when the soils are wet, and a moderate degree of soil displacement when the soils are dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting

timber production. The occasional flooding hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVw.

267—Udifluvents, moist, 0 to 8 percent slopes.

These very deep, well drained soils are on low stream terraces and in drainageways. They formed in alluvium. The native vegetation is mainly conifers and shrubs. Elevation is 1,300 to 2,500 feet. The average annual precipitation is about 70 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 150 days.

No single profile is representative of these soils. One of the more commonly observed ones, however, is covered with a mat of needles, leaves, and twigs 2 inches thick. Typically, the surface layer is very dark grayish brown and dark brown gravelly sandy loam 6 inches thick. The upper 15 inches of the underlying material is dark brown very gravelly loamy sand. The lower part to a depth of 60 inches is brown, stratified extremely gravelly sandy loam and extremely gravelly sandy clay loam. The depth to stratified, loamy or sandy, gravelly material is 15 to 50 inches. In some areas the surface layer is sandy loam, loam, or silt loam.

Included in this unit are small areas of Ohop soils, soils that are similar to the Udifluvents but have a water table at a depth of 2 to 5 feet, and organic soils. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid or rapid in the Udifluvents. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very slow, and there is no hazard of erosion. These soils are subject to occasional, brief periods of flooding from December through April.

This unit is used as woodland. Western hemlock, red alder, and Douglas fir are the main woodland species. Among the trees of limited extent is western redcedar. The common forest understory plants are vine maple, western swordfern, red huckleberry, Oregongrape, longtube twinflower, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index is estimated to be 138 for western hemlock and 149 for Douglas fir. On the basis of a 50-year site curve, it is estimated to be 100 for western hemlock and

red alder and 115 for Douglas fir. The highest average growth rate in unmanaged, even-aged stands of western hemlock is about 274 cubic feet per acre per year, occurring at age 50. For red alder it is about 118 cubic feet per acre per year, occurring at age 40. For Douglas fir it is about 157 cubic feet per acre per year, occurring at age 60.

The main limitations affecting timber harvesting are occasional snowpack and the flooding. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soils are wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soils. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available.

Equipment and logs on the surface result in a moderate degree of soil compaction when the soils are moist, a moderate degree of puddling when the soils are wet, and a moderate degree of soil displacement when the soils are dry. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction, puddling, and displacement. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling mortality is the main concern affecting timber production. The occasional flooding hinders root respiration and thus results in a low seedling survival rate. A low content of moisture in the surface layer during the growing season hinders the survival of planted and naturally established seedlings. Reforestation can be accomplished by planting western hemlock or Douglas fir seedlings. If seed trees are available, natural reforestation of cutover areas by red alder and western hemlock occurs readily.

This unit is in capability subclass VIw.

268—Vailton silt loam, 8 to 30 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in a mixture of volcanic ash and colluvium and residuum derived from siltstone and sandstone. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 10 inches, the upper part of the surface layer is dark brown silt loam. The lower 5 inches is brown silt loam. The upper 22 inches of the subsoil is

dark yellowish brown silt loam. The lower 6 inches is dark brown silty clay loam. Weathered sandstone is at a depth of about 43 inches. The depth to weathered sandstone ranges from 40 to 60 inches. In some areas the surface layer is loam. In other areas the soil has a seasonal high water table at a depth of 40 to 60 inches from December through April or is more than 60 inches deep over bedrock.

Included in this unit are small areas of Jonas and Pheeney soils and Vailton soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Vailton soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are Oregon grape, deer fern, Oregon fairybells, Oregon oxalis, western swordfern, western brackenfern, red elderberry, Pacific trillium, red huckleberry, violet, Pacific yew, salal, vine maple, and salmonberry.

On the basis of a 100-year site curve, the mean site index is 141 for Douglas fir and 146 for western hemlock. On the basis of a 50-year site curve, it is 113 for Douglas fir and 103 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 146 cubic feet per acre per year, occurring at age 65. For western hemlock it is 230 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting

timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

269—Vailton silt loam, 30 to 65 percent slopes.

This deep, well drained soil is on mountain back slopes. It formed in a mixture of volcanic ash and colluvium and residuum derived from siltstone and sandstone. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 170 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 3 inches thick. When mixed to a depth of 10 inches, the upper part of the surface layer is dark brown silt loam. The lower 5 inches is brown silt loam. The upper 22 inches of the subsoil is dark yellowish brown silt loam. The lower 6 inches is dark brown silty clay loam. Weathered sandstone is at a depth of about 43 inches. The depth to weathered sandstone ranges from 40 to 60 inches. In some areas the surface layer is loam. In other areas the soil has a seasonal high water table at a depth of 40 to 60 inches from December through April or is more than 60 inches deep over bedrock.

Included in this unit are small areas of Jonas and Pheeney soils and Vailton soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Vailton soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are Oregon grape, deer fern, Oregon fairybells, Oregon oxalis, western swordfern, western brackenfern, red elderberry, Pacific trillium, red huckleberry, violet, Pacific yew, salal, vine maple, and salmonberry.

On the basis of a 100-year site curve, the mean site index is 141 for Douglas fir and 146 for western hemlock. On the basis of a 50-year site curve, it is 113 for Douglas fir and 103 for western hemlock. The

highest average growth rate in unmanaged, even-aged stands of Douglas fir is 146 cubic feet per acre per year, occurring at age 65. For western hemlock it is 230 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir, western hemlock, or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

270—Voight silt loam, 6 to 15 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in residuum and colluvium derived dominantly from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and bark 10 inches thick. The surface layer is very dark grayish brown silt loam 11 inches thick. The upper 32 inches of the subsoil is

brown silty clay loam. The lower 15 inches is reddish brown silty clay loam. The substratum to a depth of 60 inches is dark reddish brown and brown silt loam. In some areas the surface layer is silty clay loam, loam, or sandy loam. In other areas the soil has 15 to 35 percent weathered rock fragments in the subsoil and substratum or has 10 to 18 percent clay in the subsoil.

Included in this unit are small areas of Jonas, Pheeney, Scamman, and Zynbar soils and Voight soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Voight soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, vine maple, salal, Oregongrape, western brackenfern, Oregon oxalis, trailing blackberry, deer fern, red huckleberry, and Pacific trillium.

On the basis of a 100-year site curve, the mean site index is 145 for Douglas fir and 148 for western hemlock. On the basis of a 50-year site curve, it is 114 for Douglas fir and 105 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 152 cubic feet per acre per year, occurring at age 60. For western hemlock it is 234 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in

productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

271—Voight silt loam, 15 to 30 percent slopes.

This very deep, well drained soil is on mountain back slopes. It formed in residuum and colluvium derived dominantly from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and bark 10 inches thick. The surface layer is very dark grayish brown silt loam 11 inches thick. The upper 32 inches of the subsoil is brown silty clay loam. The lower 15 inches is reddish brown silty clay loam. The substratum to a depth of 60 inches is dark reddish brown and brown silt loam. In some areas the surface layer is silty clay loam, loam, or sandy loam. In other areas the soil has 15 to 35 percent weathered rock fragments in the subsoil and substratum or has 10 to 18 percent clay in the subsoil.

Included in this unit are small areas of Jonas, Pheeney, Scamman, and Zynbar soils and Voight soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Voight soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, vine maple, salal, Oregongrape, western brackenfern, Oregon oxalis, trailing blackberry, deer fern, red huckleberry, and Pacific trillium.

On the basis of a 100-year site curve, the mean site index is 145 for Douglas fir and 148 for western

hemlock. On the basis of a 50-year site curve, it is 114 for Douglas fir and 105 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 152 cubic feet per acre per year, occurring at age 60. For western hemlock it is 234 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

272—Voight silt loam, 30 to 65 percent slopes.

This very deep, well drained soil is on mountain back slopes. It formed in residuum and colluvium derived dominantly from extrusive igneous rocks. The native vegetation is mainly conifers and shrubs. Elevation is 1,700 to 2,800 feet. The average annual precipitation is about 75 inches, and the average annual air temperature is about 43 degrees F. The average frost-free period is about 145 days.

Typically, the surface is covered with a mat of needles, leaves, twigs, and bark 10 inches thick. The surface layer is very dark grayish brown silt loam 11 inches thick. The upper 32 inches of the subsoil is

brown silty clay loam. The lower 15 inches is reddish brown silty clay loam. The substratum to a depth of 60 inches is dark reddish brown and brown silt loam. In some areas the surface layer is silty clay loam, loam, or sandy loam. In other areas the soil has 15 to 35 percent weathered rock fragments in the subsoil and substratum or has 10 to 18 percent clay in the subsoil.

Included in this unit are small areas of Jonas, Pheaney, Scamman, and Zynbar soils and Voight soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Voight soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, vine maple, salal, Oregon grape, western brackenfern, Oregon oxalis, trailing blackberry, deer fern, red huckleberry, and Pacific trillium.

On the basis of a 100-year site curve, the mean site index is 145 for Douglas fir and 148 for western hemlock. On the basis of a 50-year site curve, it is 114 for Douglas fir and 105 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 152 cubic feet per acre per year, occurring at age 60. For western hemlock it is 234 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. During an average year, snowpack limits the use of equipment and restricts access from January through March. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gulying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths,

properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects and a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock and red alder occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

273—Welcome loam, 0 to 30 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in volcanic ash, colluvium, and slope alluvium derived dominantly from sandstone and modified by glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,500 feet. The average annual precipitation is about 80 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles and twigs 1 inch thick. When mixed to a depth of 5 inches, the surface layer is dark brown loam. The upper 7 inches of the subsoil is strong brown silt loam. The lower 23 inches is dark yellowish brown and light olive brown gravelly loam. The substratum is light olive brown fine sandy loam 18 inches thick. Weathered sandstone that crushes to loamy sand is at a depth of about 53 inches. The depth to weathered sandstone ranges from 40 to 60 inches. The content of soft rock fragments ranges from 15 to 35 percent. In some areas the surface layer is sandy loam or silt loam. In other areas the soil is 40 to 60 inches deep to dense glacial till or is more than 60 inches deep over bedrock.

Included in this unit are small areas of Elwell, Oakes, and Olomount soils and Welcome soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Welcome soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder and western redcedar. The common forest understory plants are red huckleberry, longtube twinflower, western

swordfern, salal, and western brackenfern.

On the basis of a 100-year site curve, the mean site index is 135 for Douglas fir and is estimated to be 129 for western hemlock. On the basis of a 50-year site curve, it is 106 for Douglas fir and is estimated to be 89 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 139 cubic feet per acre per year, occurring at age 70. For western hemlock it is about 198 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

274—Welcome loam, 30 to 65 percent slopes. This deep, well drained soil is on mountain back slopes. It formed in volcanic ash, colluvium, and slope alluvium derived dominantly from sandstone and modified by glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,800 to 2,500 feet. The average

annual precipitation is about 80 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles and twigs 1 inch thick. When mixed to a depth of 5 inches, the surface layer is dark brown loam. The upper 7 inches of the subsoil is strong brown silt loam. The lower 23 inches is dark yellowish brown and light olive brown gravelly loam. The substratum is light olive brown fine sandy loam 18 inches thick. Weathered sandstone that crushes to loamy sand is at a depth of about 53 inches. The depth to weathered sandstone ranges from 40 to 60 inches. The content of soft rock fragments ranges from 15 to 35 percent. In some areas the surface layer is sandy loam or silt loam. In other areas the soil is 40 to 60 inches deep to dense glacial till or is more than 60 inches deep over bedrock.

Included in this unit are small areas of Elwell, Oakes, and Olomount soils and Welcome soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Welcome soil. Available water capacity is high. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder and western redcedar. The common forest understory plants are red huckleberry, longtube twinflower, western swordfern, salal, and western brackenfern.

On the basis of a 100-year site curve, the mean site index is 135 for Douglas fir and is estimated to be 129 for western hemlock. On the basis of a 50-year site curve, it is 106 for Douglas fir and is estimated to be 89 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 139 cubic feet per acre per year, occurring at age 70. For western hemlock it is about 198 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. During an average year, snowpack limits the use of equipment and restricts access from January through March. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Because most of the roots are concentrated in the organic mat, loss of this layer after logging greatly reduces natural fertility and the available water capacity. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods.

The rock available for road construction is poor-quality sandstone. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. The seedling mortality rate is higher on ridgetops that are subject to strong, persistent winds than in other areas of this unit. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by western hemlock occurs readily and reforestation by Douglas fir occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

275—Wilkeson gravelly silt loam, 6 to 15 percent slopes. This very deep, well drained soil is on foothills. It formed in residuum and colluvium derived dominantly from andesite and basalt. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 150 days.

When mixed to a depth of 8 inches, the surface layer is typically dark brown gravelly silt loam. The upper 8 inches of the subsoil is brown gravelly silt loam. The next 18 inches is dark yellowish brown gravelly loam and yellowish brown loam. The lower part to a depth of 60 inches is dark yellowish brown loam and yellowish brown gravelly loam. In some areas the surface layer is silt loam or loam. In other areas the soil has 27 to 35 percent clay in the subsoil.

Included in this unit are small areas of Mashel and Scamman soils and Wilkeson soils that have slopes of more than 15 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Wilkeson soil. Available water capacity is high. The effective rooting

depth is 60 inches or more. In most areas, runoff is slow and the hazard of water erosion is slight. In areas used as pasture, however, runoff is medium and the hazard of erosion is moderate.

This unit is used as woodland. It also is suitable as pasture and hayland.

Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, bigleaf maple, western redcedar, and bitter cherry. The common forest understory plants are western swordfern, vine maple, Oregongrape, red huckleberry, western brackenfern, Pacific trillium, trailing blackberry, bedstraw, salal, and violet.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 161. On the basis of a 50-year site curve, it is 122. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 171 cubic feet per acre per year, occurring at age 65.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

276—Wilkeson gravelly silt loam, 15 to 30 percent slopes. This very deep, well drained soil is on foothills. It formed in residuum and colluvium derived dominantly

from andesite and basalt. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 150 days.

When mixed to a depth of 8 inches, the surface layer is typically dark brown gravelly silt loam. The upper 8 inches of the subsoil is brown gravelly silt loam. The next 18 inches is dark yellowish brown gravelly loam and yellowish brown loam. The lower part to a depth of 60 inches is dark yellowish brown loam and yellowish brown gravelly loam. In some areas the surface layer is silt loam or loam. In other areas the soil has 27 to 35 percent clay in the subsoil.

Included in this unit are small areas of Mashel and Scamman soils and Wilkeson soils that have slopes of more than 30 percent or less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Wilkeson soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, bigleaf maple, western redcedar, and bitter cherry. The common forest understory plants are western swordfern, vine maple, Oregongrape, red huckleberry, western brackenfern, Pacific trillium, trailing blackberry, bedstraw, salal, and violet.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 161. On the basis of a 50-year site curve, it is 122. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 171 cubic feet per acre per year, occurring at age 65.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep skid trails and firebreaks are subject to rilling and gullyng unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of

compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

277—Wilkeson gravelly silt loam, 30 to 45 percent slopes. This very deep, well drained soil is on foothills. It formed in residuum and colluvium derived dominantly from andesite and basalt. The native vegetation is mainly conifers and shrubs. Elevation is 600 to 1,800 feet. The average annual precipitation is about 60 inches, and the average annual air temperature is about 47 degrees F. The average frost-free period is about 150 days.

When mixed to a depth of 8 inches, the surface layer is typically dark brown gravelly silt loam. The upper 8 inches of the subsoil is brown gravelly silt loam. The next 18 inches is dark yellowish brown gravelly loam and yellowish brown loam. The lower part to a depth of 60 inches is dark yellowish brown loam and yellowish brown gravelly loam. In some areas the surface layer is silt loam or loam. In other areas the soil has 27 to 35 percent clay in the subsoil.

Included in this unit are small areas of Mashel and Scamman soils and Wilkeson soils that have slopes of more than 45 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Wilkeson soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir is the main woodland species. Among the trees of limited extent are red alder, western hemlock, bigleaf maple, western redcedar, and bitter cherry. The common forest understory plants are western swordfern, vine maple, Oregongrape, red huckleberry, western brackenfern, Pacific trillium, trailing blackberry, bedstraw, salal, and violet.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 161. On the basis of a 50-year site curve, it is 122. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 171 cubic feet per acre per year, occurring at age 65.

The main limitations affecting timber harvesting are the slope and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Unmanaged fires in undisturbed areas result in a moderate reduction in productivity on north aspects a severe reduction on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIe.

278—Winston loam, 0 to 8 percent slopes. This very deep, well drained soil is on outwash terraces. It formed in volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,500 feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 11 inches, the surface layer is dark brown loam. The upper 10 inches of the subsoil is dark brown gravelly loam. The lower 13 inches is dark brown gravelly fine sandy loam. The substratum to a depth of 60 inches is very dark grayish brown extremely gravelly sand. The depth to extremely gravelly sand ranges from 14 to 38 inches. In some areas the surface layer is silt

loam or gravelly loam. In other areas the substratum is very gravelly sandy loam or has 15 to 35 percent rock fragments.

Included in this unit are small areas of Barneston, Blethen, and Sulsavar soils, soils that are less than 14 inches deep to extremely gravelly sand, Shalcar soils in depressions, and Winston soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the upper part of the Winston soil and very rapid in the substratum. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly as woodland. It also is used for hay and pasture.

In the areas used for hay and pasture, the main limitations are compaction and the hazard of erosion. Proper stocking rates, pasture rotation, and restricted grazing during short wet periods help to keep the pasture in good condition and help to control runoff and erosion. In summer, irrigation is required for maximum production.

Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are salal, Oregongrape, western brackenfern, western swordfern, vine maple, red huckleberry, trailing blackberry, evergreen blackberry, rose, salmonberry, devilscub, and violet.

On the basis of a 100-year site curve, the mean site index is 164 for Douglas fir and 162 for western hemlock. On the basis of a 50-year site curve, it is 125 for Douglas fir and 114 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 174 cubic feet per acre per year, occurring at age 60. For western hemlock it is 258 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rounded pebbles for road construction are readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A

moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IIIe.

279—Winston loam, 8 to 30 percent slopes. This very deep, well drained soil is on outwash terraces and escarpments. It formed in volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,500 feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 11 inches, the surface layer is dark brown loam. The upper 10 inches of the subsoil is dark brown gravelly loam. The lower 13 inches is dark brown gravelly fine sandy loam. The substratum to a depth of 60 inches is very dark grayish brown extremely gravelly sand. The depth to extremely gravelly sand ranges from 14 to 38 inches. In some areas the surface layer is silt loam or gravelly loam. In other areas the substratum is very gravelly sandy loam or has 15 to 35 percent rock fragments.

Included in this unit are small areas of Barneston, Blethen, and Sulsavar soils, soils that are less than 14 inches deep to extremely gravelly sand, Shalcar soils in depressions, and Winston soils that have slopes of more than 30 percent or less than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the upper part of the Winston soil and very rapid in the substratum. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are salal, Oregongrape, western brackenfern, western swordfern, vine maple, red huckleberry, trailing blackberry, evergreen blackberry, rose, salmonberry, devilscub, and violet.

On the basis of a 100-year site curve, the mean site

index is 164 for Douglas fir and 162 for western hemlock. On the basis of a 50-year site curve, it is 125 for Douglas fir and 114 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 174 cubic feet per acre per year, occurring at age 60. For western hemlock it is 258 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rounded pebbles for road construction are readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

280—Winston loam, windswept, 0 to 30 percent slopes. This very deep, well drained soil is on outwash terraces and escarpments. It formed in volcanic ash and glacial outwash. The native vegetation is mainly conifers and shrubs. Elevation is 1,000 to 1,500 feet. The average annual precipitation is about 55 inches, and the average annual air temperature is about 48 degrees F. The average frost-free period is about 160 days.

Typically, the surface is covered with a mat of needles, leaves, and twigs 1 inch thick. When mixed to a depth of 11 inches, the surface layer is dark brown loam. The upper 10 inches of the subsoil is dark brown gravelly loam. The lower 13 inches is dark brown gravelly fine sandy loam. The substratum to a depth of 60 inches is very dark grayish brown extremely gravelly sand. The depth to extremely gravelly sand ranges from 14 to 38 inches. In some areas the surface layer is silt loam or gravelly loam. In other areas the substratum is

very gravelly sandy loam or has 15 to 35 percent rock fragments.

Included in this unit are small areas of Barneston, Blethen, and Sulsavar soils, soils that are less than 14 inches deep to extremely gravelly sand, Shalcar soils in depressions, and Winston soils that have slopes of more than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the upper part of the Winston soil and very rapid in the substratum. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, bigleaf maple, and western redcedar. The common forest understory plants are salal, Oregongrape, western brackenfern, western swordfern, vine maple, red huckleberry, trailing blackberry, evergreen blackberry, rose, salmonberry, devilsclub, and violet.

On the basis of a 100-year site curve, the mean site index for Douglas fir is estimated to be 117. On the basis of a 50-year site curve, it is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is about 110 cubic feet per acre per year, occurring at age 60. Estimates of the site index and growth rate of western hemlock have not been made. The trees are desiccated in winter by winds blowing west from the Cascade Mountains.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rounded pebbles for road construction are readily available.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or red alder seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily and reforestation by western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and

growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

281—Woodinville silt loam, 0 to 2 percent slopes.

This very deep, poorly drained soil is on flood plains. It formed in alluvium stratified with decomposed organic material. The native vegetation is mainly trees and shrubs. Elevation is 50 to 120 feet. The average annual precipitation is about 45 inches, and the average annual air temperature is about 50 degrees F. The average frost-free period is about 190 days.

Typically, the surface layer is dark brown silt loam 7 inches thick. The upper 5 inches of the underlying material is light olive gray silt loam. The next 3 inches is olive gray silt loam. The lower part to a depth of 60 inches is dark brown and grayish brown, stratified silt loam and sapric material. In some areas the surface layer is silty clay loam. In other areas the soil has a dark brown surface layer. In places the substratum does not have sapric material, has 10 to 18 percent clay, or has thin strata of sand.

Included in this unit are small areas of undrained Woodinville soils, Shalcar soils in depressions that are subject to ponding, and small bodies of water. Included areas make up about 10 percent of the total acreage.

Permeability is moderately slow in the Woodinville soil. Available water capacity is high. The effective rooting depth is limited by an apparent high water table, which is at a depth of 1.5 to 3.0 feet from October through April. Runoff generally is very slow, but can be ponded during the winter months. There is no hazard of erosion. This soil is subject to rare flooding.

This unit is used mainly for hay and pasture. The included undrained Woodinville soils are used as woodland.

In the areas used for hay and pasture, the main limitations are the high water table, the hazard of flooding, and the moderately slow permeability. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Grazing when the soil is wet results in compaction of the surface layer and poor tilth. In undrained areas and in areas where the drainage system is not maintained, the water table limits the choice of forage species to grasses and shallow-rooted legumes. The wetness in these areas limits the period of cutting or grazing and increases the risk of winterkill.

The main limitations affecting cropland are the high water table, the hazard of flooding, and the moderately slow permeability. This soil is well suited to most of the crops commonly grown in the survey area if adequate drainage systems are maintained. The principal crops

are corn silage and small grain. Returning all crop residue to the soil and including grasses, legumes, or grass-legume mixtures in the cropping sequence help to maintain fertility and tilth. During the growing season, the water table is lowered by tile drains and field ditches to a depth of about 3 to 5 feet. Measures that maintain the drainage system are needed to ensure adequate production. Maintaining the drainage system permits fieldwork to be conducted earlier in the spring and increases the yields of perennial crops. In summer, irrigation is required for maximum production.

Red alder is the main woodland species. Among the trees of limited extent are western redcedar and black cottonwood. The common forest understory plants are spirea, rose, vine maple, and sedges.

On the basis of a 50-year site curve, the mean site index for red alder is estimated to be 90. The highest average growth rate in unmanaged, even-aged stands of red alder is about 101 cubic feet per acre per year, occurring at age 40.

The main limitation affecting timber harvesting is the muddiness caused by seasonal wetness. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas.

Seedling establishment, seedling mortality, and the hazard of windthrow are the main concerns affecting timber production. The seasonal high water table hinders root respiration and thus results in a low seedling survival rate. Reforestation can be accomplished by planting red alder or western redcedar seedlings. If seed trees are available, natural reforestation of cutover areas by red alder occurs readily. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can prevent the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means. Because the rooting depth is restricted by the high water table, trees are frequently subject to windthrow when the soil is wet and winds are strong.

This unit is in capability subclass IIw.

282—Zynbar loam, 6 to 30 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in a mixture of volcanic ash, colluvium derived from igneous rocks, and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of needles, twigs, and bark 2 inches thick. When mixed to a depth of 18 inches, the surface layer is dark brown loam. The subsoil is dark yellowish brown gravelly silt loam 23 inches thick. The substratum to a depth of 60 inches is dark yellowish brown silt loam. In some areas the surface layer is silt loam. In other areas the soil has strata of sandy material in the subsoil, has 35 to 50 percent rock fragments in the substratum, or is underlain by dense glacial till at a depth of 40 to 60 inches.

Included in this unit are small areas of Jonas and Pitcher soils and Zynbar soils that have slopes of more than 30 percent or less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Zynbar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are Oregongrape, western brackenfern, western swordfern, vine maple, red huckleberry, trailing blackberry, common beargrass, Oregon oxalis, Pacific trillium, violet, devilsclub, bedstraw, and salal.

On the basis of a 100-year site curve, the mean site index is 161 for Douglas fir and 157 for western hemlock. On the basis of a 50-year site curve, it is 123 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 171 cubic feet per acre per year, occurring at age 65. For western hemlock it is 249 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require

suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

283—Zynbar loam, 30 to 65 percent slopes. This very deep, well drained soil is on mountain back slopes. It formed in a mixture of volcanic ash, colluvium derived from igneous rocks, and glacial till. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of needles, twigs, and bark 2 inches thick. When mixed to a depth of 18 inches, the surface layer is dark brown loam. The subsoil is dark yellowish brown gravelly silt loam 23 inches thick. The substratum to a depth of 60 inches is dark yellowish brown silt loam. In some areas the surface layer is silt loam. In other areas the soil has strata of sandy material in the subsoil, has 35 to 50 percent rock fragments in the substratum, or is underlain by dense glacial till at a depth of 40 to 60 inches.

Included in this unit are small areas of Jonas and Pitcher soils and Zynbar soils that have slopes of more than 65 percent or less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Zynbar soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland. Douglas fir and

western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are Oregongrape, western brackenfern, western swordfern, vine maple, red huckleberry, trailing blackberry, common beargrass, Oregon oxalis, Pacific trillium, violet, devilsclub, bedstraw, and salal.

On the basis of a 100-year site curve, the mean site index is 161 for Douglas fir and 157 for western hemlock. On the basis of a 50-year site curve, it is 123 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 171 cubic feet per acre per year, occurring at age 65. For western hemlock it is 249 cubic feet per acre per year, occurring at age 50.

The main limitations affecting timber harvesting are the slope, occasional snowpack, and the hazard of erosion. When timber is harvested, the slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and disturb the surface less extensively. They generally are used on this unit. During an average year, snowpack limits the use of equipment and restricts access from January through March. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface. Cut and fill slopes tend to slump when wet.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and cable yarding paths, properly timing their use, or using cable systems that lift logs entirely off the ground can reduce the degree of compaction and puddling and the hazard of erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. A moderate reduction in productivity can be expected to result from unmanaged fires in undisturbed areas on south aspects.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass VIIe.

284—Zynbar silt loam, till substratum, 0 to 15 percent slopes. This very deep, moderately well drained soil is on mountain back slopes. It formed in a mixture of volcanic ash and andesitic colluvium over glacial drift. The native vegetation is mainly conifers and shrubs. Elevation is 1,600 to 2,300 feet. The average annual precipitation is about 85 inches, and the average annual air temperature is about 44 degrees F. The average frost-free period is about 150 days.

Typically, the surface is covered with a mat of needles, twigs, and bark 2 inches thick. The surface layer is dark brown silt loam 9 inches thick. The upper 20 inches of the subsoil also is dark brown silt loam. The lower part to a depth of 60 inches or more is yellowish brown very gravelly silt loam. In some areas the surface layer is loam or gravelly silt loam. In other areas the soil has strata of sandy material in the subsoil, has 35 to 50 percent rock fragments in the substratum, or is 20 to 40 inches deep to dense glacial till.

Included in this unit are small areas of Jonas and Pitcher soils and Zynbar soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Zynbar soil. Available water capacity is high. The effective rooting depth is limited by a perched high water table, which is at a depth of 3 or 4 feet from December through March. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland. Douglas fir and western hemlock are the main woodland species. Among the trees of limited extent are red alder, western redcedar, and bigleaf maple. The common forest understory plants are western swordfern, red huckleberry, salal, western brackenfern, Oregon oxalis, salmonberry, devilsclub, longtube twinflower, Oregongrape, and trailing blackberry.

On the basis of a 100-year site curve, the mean site index is 161 for Douglas fir and 157 for western hemlock. On the basis of a 50-year site curve, it is 123 for Douglas fir and 110 for western hemlock. The highest average growth rate in unmanaged, even-aged stands of Douglas fir is 171 cubic feet per acre per year, occurring at age 65. For western hemlock it is 249 cubic feet per acre per year, occurring at age 50.

The main limitation affecting timber harvesting is occasional snowpack. During an average year, snowpack limits the use of equipment and restricts access from January through March. The use of wheeled and tracked equipment when the soil is wet causes excessive rutting. Using low-pressure ground

equipment can minimize damage to the soil. Unsurfaced roads are soft and slippery when wet and are subject to deep rutting during rainy periods. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available. Extra rock is needed to maintain a stable and uniform road surface.

Equipment and logs on the surface result in a high degree of soil compaction when the soil is moist and a high degree of puddling when the soil is wet. Carefully laying out roads and skid trails, properly timing their use, and using low-pressure ground equipment can reduce the degree of compaction and puddling. Steep skid trails and firebreaks are subject to rilling and

gullying unless adequate water bars are provided or a protective plant cover is established.

Seedling establishment is the main concern affecting timber production. Reforestation can be accomplished by planting Douglas fir or western hemlock seedlings. If seed trees are available, natural reforestation of cutover areas by red alder and western hemlock occurs periodically. When openings are made in the canopy, the uncontrolled invasion and growth of competing plants can delay the establishment of seedlings. Competing vegetation can be controlled by mechanical or chemical means.

This unit is in capability subclass IVe.

Prime Farmland

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, seed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils either are used for food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and length of growing season are favorable, and the level of acidity or alkalinity is acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long

periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

Some soils that have a seasonal high water table qualify as prime farmland soils only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 51,170 acres, or more than 4 percent of the survey area, meets the requirements for prime farmland or would meet the requirements if adequate drainage systems were installed. The map units in the survey area that are considered prime farmland or meet the requirements for prime farmland where they are drained are listed in table 5. The location of each map unit is shown on the detailed soil maps at the back of this publication. Soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

In this section, the system of land capability classification used by the Soil Conservation Service is explained. Planners of management systems for individual fields or farms should consider the detailed

information given in the description of each soil under "Detailed Soil Map Units." Specific information, such as yield data, can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Most of the survey area is forested. The slopes are steeper and the growing season is shorter in the forested areas than in the lowlands. Most of the prime farmland in the survey area that is not forested is pasture. Agricultural crops are not grown in the survey area. If a drainage system were installed, they could be grown in areas where the growing season is long enough for the crops to mature.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (30). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the

choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 11e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Woodland Management and Productivity

By William J. Westberg, consulting forester, Washington State Department of Natural Resources.

This section provides a description of the forest zones within the survey area and of the environmental variables that influence forest productivity, an overview of forest management considerations, and an explanation of woodland suitability symbols and of site indexes, which are values used for quantifying potential forest productivity.

About 90 percent of the survey area supports trees in various stages of growth. The forest land is used mainly for the production of timber. It also is used for watershed, for wildlife habitat, and as a site for recreational activities. Other areas include high

mountain meadows, pastures, towns and villages, industrial sites, and highway and railroad right-of-ways.

Forest Ecology and Productivity

The survey area has three distinct forest zones characterized by unique plant communities. The first is the western hemlock zone, which ranges in elevation from sea level to about 2,700 feet above sea level. It is in river valleys and on glacial drift plains and foothills. The second is the Pacific silver fir zone, which ranges in elevation from about 1,700 to 4,200 feet. It is on mountains and high mountains. The third is the mountain hemlock zone. It ranges in elevation from 4,200 feet to the timberline, which is at about 5,500 feet. It is on high mountains. The exact elevation at which adjacent zones merge into each other varies, depending on local environmental conditions.

The *western hemlock zone* is the largest of the three zones. It is the most important zone for the production of timber. It has a wet, mild, maritime climate. The mean annual precipitation ranges from about 50 inches at the base of the Cascade Mountains to about 110 inches at the transition to the Pacific silver fir zone. Summers are relatively dry, receiving less than 10 percent of the total annual rainfall. The mean annual temperature is about 47 degrees F.

This zone supports extensive second-growth stands of Douglas fir and some remnant, old-growth stands of mixed western hemlock and Douglas fir. The name of the zone is derived from the predominance of western hemlock in the oldest stands. Douglas fir and western redcedar are important coniferous species in this zone. Sitka spruce grows in some areas along watercourses. Pacific silver fir grows at the highest elevations in the zone. In unmanaged stands the proportion of western hemlock to Douglas fir increases with increasing elevation.

Deciduous trees are common on disturbed sites, primarily logged or burned areas. They also are common along watercourses, in poorly drained areas, and in excessively drained areas. Red alder, bigleaf maple, and black cottonwood are the most common species, especially in low, moist areas. Bigleaf maple also is common on dry, south- and west-facing escarpments. Madrona grows in the driest areas.

Typically, the understory shrubs in this zone are Oregon grape, salal, red huckleberry, vine maple, and Pacific yew. The common herbaceous plants are western swordfern, northern twinflower, trillium, deer fern, evergreen violet, and Oregon oxalis.

Talus slopes are common throughout the survey area. They are dominated by vine maple and shrubs, such as creambush oceanspray, creeping snowberry,

and California hazel. Typically, the herbaceous plants on these dry sites are common beargrass, parsley fern, and lace fern.

The *Pacific silver fir zone* is wetter and cooler than the western hemlock zone and receives more snowfall. The mean annual precipitation is about 110 inches, much of which accumulates as winter snowpack. The snowpack reaches a depth of about 10 feet. The mean annual temperature is about 42 degrees F.

This zone is dominated by Pacific silver fir. Other common species are western hemlock, noble fir, western redcedar, and Douglas fir and a few mountain hemlock and Alaska cedar. Deciduous trees are not common. Western hemlock, which is most common at the lower elevations, is typically displaced by mountain hemlock and Alaska cedar near the upper limits of the zone. Western redcedar and Douglas fir are most common near the transition to the western hemlock zone.

Typically, the understory shrubs are vine maple, Oregongrape, salal, red huckleberry, tall blue huckleberry, and Alaska huckleberry. The common herbaceous plants are common beargrass, northern twinflower, bunchberry dogwood, queencup beadlily, and vanillaleaf.

Sitka alder grows to a height of 15 feet on some avalanche chutes. Alaska cedar grows in scattered areas adjacent to some of the avalanche chutes.

The *mountain hemlock zone* is the wettest and coolest of the three forest zones. It is the smallest zone and the least important for the production of timber. The mean annual precipitation is about 130 inches. The winter snowpack can reach a depth of 25 feet. The mean annual temperature is about 39 degrees F.

Alaska cedar and Pacific silver fir are associated with mountain hemlock throughout the zone. Mountain hemlock, however, generally dominates the oldest stands. Typically, the understory scrubs and herbaceous plants are similar to those in the lower adjacent zone.

Forest productivity ranges from high on the rolling uplands of the western hemlock zone to very low on the high ridge crests of the Pacific silver fir zone and the mountain hemlock zone. It varies within each zone, depending on a combination of environmental factors that affect tree growth.

Factors that influence productivity include elevation, content of rock fragments in the soil, the content and depth of organic matter, the position and aspect of slopes, exposure to persistent wind, and the amount of clay and volcanic ash in the soil. Generally, productivity decreases as elevation and the content of rock fragments increase and as the depth to bedrock decreases. Soils that are less than 18 inches deep over

bedrock are unable to support sustained growth. Productivity increases as the content and depth of incorporated organic matter increase. It tends to be lower on ridge crests and the upper slopes and higher on foot slopes. South- and west-facing slopes are less productive than north- and east-facing slopes. Productivity is decreased in some areas by persistent wind, depending on the force, constancy, and moisture content of the wind. Persistent wind has the greatest effect when the ground is frozen. A moderate amount of clay or fine volcanic ash in the soil can increase productivity.

Management Considerations

Stand establishment is the primary concern affecting the production of timber in the survey area. The most common method of establishment is planting coniferous seedlings. Natural regeneration, however, occurs where the stands include seed trees. It commonly results in the establishment of mixed stands. The proportion of undesirable species varies in naturally regenerated stands, and the growth of red alder can be a significant problem at the lower elevations.

Droughtiness in the surface layer, which is caused by a low amount of rainfall and high temperatures during the growing season, reduces the seedling survival rate. It is especially critical in sandy soils and in soils that have a high content of rock fragments or of coarse volcanic ash and cinders near the surface. The seedling survival rate also is reduced by fires or harvesting methods that remove the protective layer of organic material and by persistent winds, which dry the soil. Persistent winds are common on exposed ridge crests, on side slopes and constrictions in wide valleys, and on alluvial fans at the head of some of the major drainageways.

Typically, the plant nutrients in soils that formed in glacial outwash or at high elevations are concentrated in dark layers near the surface. If these layers are destroyed by intensive burning or by careless harvesting methods, fertility can be seriously reduced.

When wet, soils that have fine textured or medium textured surface layers are subject to compaction and rutting. Compaction reduces the seedling survival rate and the growth rate of the more mature trees by restricting permeability and root development. Rutting may expose tree roots to damage by ground equipment.

A high water table during the growing season restricts the depth of the root zone, reducing productivity. Shallow-rooted trees are subject to windthrow. The use of wheeled or tracked vehicles is restricted during wet periods. Saturated soils can be invaded by undesirable deciduous species.

The main limitation affecting timber harvesting is the

slope. The use of ground equipment on soils that have slopes of more than 30 percent generally is impractical and dangerous. Cable systems are safer and disturb the surface less extensively.

In steep areas road construction is influenced more by the underlying material than by the soil. Soil characteristics are important in gently sloping areas and in poorly drained areas. Glacial outwash, alluvium, and unweathered bedrock provide a stable base for roads. These construction materials generally can be easily located. Roads built in steep areas underlain by breccia, phyllite, or sandstone or through thick deposits of volcanic ash and cinders are subject to mass movement. Sidecast material may slough when saturated. Roads on gently sloping soils that have a fine or medium texture require suitable surfacing for year-round use. Roads in poorly drained areas require a thicker base and extra culverts. Raveling of the soil material can occur along roads constructed with steep cuts through areas of dry outwash.

Generally, the hazard of erosion is minor in forested areas. Rill and gully erosion may occur where harvesting has destroyed the protective surface layer. Steep, unsurfaced logging roads, unvegetated skid trails, and firebreaks also are subject to erosion.

The success of many woodland management practices can be predicted through knowledge of the properties of the various soils. Detailed descriptions of the soils in the survey area are in the section "Detailed Soil Map Units." The description of each map unit that is suitable for woodland provides information concerning potential productivity, the limitations affecting timber production and harvesting, and common tree species and forest understory plants.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for woodland. Only the soils suitable for woodland are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils that are assigned the same ordination symbol require the same general management and have about the same potential productivity.

The *ordination symbol* is based on a uniform system of labeling an individual soil to determine the productivity potential and the principal soil properties in relation to any hazards or limitations of that soil. The first element of the ordination symbol is a number that denotes potential productivity in terms of cubic meters of wood per hectare per year for the indicator tree species. Potential productivity is based on site index and the corresponding culmination of mean annual increment. For example, the number 1 indicates a potential production of 1 cubic meter of wood per hectare per year (14.3 cubic feet per acre per year) and

10 indicates a potential production of 10 cubic meters of wood per hectare per year (143 cubic feet per acre per year). Cubic feet multiplied by five equals the approximate volume of growth in Scribner board feet.

The second element of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *D*, restricted rooting depth; *S*, sandy texture; *F*, a high content of rock fragments in the soil, and *N*, a restriction caused by the depth or duration of the snowpack. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: *R*, *X*, *W*, *D*, *S*, *F*, and *N*.

In table 7, *slight*, *moderate*, and *severe*, indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, wetness, snowpack, and texture of the surface layer. A rating of *slight* indicates that the use of equipment is not normally restricted to a particular kind of equipment or time of year. Soil wetness can restrict the use of equipment, but the wet period does not exceed 2 months. A rating of *moderate* indicates that the use of equipment is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts the use of equipment for a period of 2 to 6 months. A rating of *severe* indicates that either the kind of equipment that can be used or the time of year it can be used is severely restricted. If the soil is wet, the wetness restricts the use of equipment for more than 6 months.

Operating wheeled equipment becomes more difficult as the gradient and length of slopes increase. The degree of difficulty generally increases on slopes of 25 to 35 percent. On steeper slopes, generally those of 35 to 45 percent, tracked equipment should be used. On the steepest slopes, even tracked equipment cannot be operated safely and more sophisticated systems should be used. Wetness, especially in combination with a fine texture, can severely limit the use of equipment, making harvesting practical only during dry summer months.

Seedling mortality refers to the of death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, wetness, climate, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, climate, and aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown over by the wind. Strong winds may damage the trees but do not uproot them. A rating of *moderate* indicates that some trees can be blown over during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown over during these periods.

Ratings of *plant competition* indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table, climate, and available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a site index and a productivity class. The *site index* is the average height, in feet, that dominant and codominant trees of a given species attain in 50 years. It applies to fully stocked, even-aged, unmanaged stands. The site index for a specific soil is derived from onsite measurements of the dominant and codominant trees of a specific species. Research literature is used to calculate the average site

index for a given species (3, 20, 22, 33, 34). Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Generally, map units with a higher site index can be expected to produce more wood fiber than those with a lower site index. A site index for a species on one map unit should be compared only to site indexes for the same species on other map units. A site index was not assigned to any minor species. Because of a lack of data or a suitable site index publication, it also was not assigned to certain principal species.

The *productivity class* represents the yield likely to be produced by the most important trees. It is expressed in cubic meters per hectare per year. It indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The species assigned the highest productivity symbol under *common trees* is the indicator species for that soil. It can be the dominant species on the soil and is the one that generally determines the ordination class.

Trees to plant are those that are suitable and preferred for commercial wood production (7, 8, 9, 10, 11).

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design,

intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

This survey area has a variety of habitats that support many species of wildlife. Habitats range from the open areas along the western boundary of the survey area to the alpine areas of the Cascades. Elevations range from 400 feet to more than 6,000 feet above sea level.

The soils on the lowlands, flood plains, and bottom land and in some warm areas in the uplands provide habitat for openland wildlife, such as pheasants, California quail, and rabbits. Other warm areas in the uplands support extensive stands of second-growth Douglas fir and red alder. Associated species include

western hemlock, western redcedar, bigleaf maple, grand fir, and bitter cherry. These wooded areas have a diverse understory vegetation that includes salal, cascade Oregongrape, western brackenfern, western swordfern, vine maple, red huckleberry, trailing blackberry, Pacific trillium, northern twinflower, violet, bedstraw, Oregon oxalis, thimbleberry, and rose. The woodland provides habitat for ruffed grouse, woodpeckers, chipmunks, squirrels, mountain beaver, coyote, black-tailed deer, and elk.

At the higher elevations, in the cool mountainous areas of the Cascades, the soils support western hemlock and Douglas fir. Associated species include Pacific silver fir, western redcedar, and red alder. The understory includes western brackenfern, red huckleberry, western swordfern, salal, deer fern, and Oregon oxalis. The wildlife in these areas include species typical of the warmer areas and black bear, bobcat, and cougar.

In the cold areas in the Cascades, the soils support stands of western hemlock, Pacific silver fir, old-growth Douglas fir, and relatively young Douglas fir. Associated species include western redcedar, noble fir, western white pine, mountain hemlock, Alaska cedar, and black cottonwood. Sitka alder and willows grow in some wet spots, seep areas, and avalanche tracks. The understory includes cascade Oregongrape, bunchberry dogwood, common beargrass, prince's pine, tall blue huckleberry, and western swordfern. The wildlife in these areas include many of the species typical of warmer areas. These colder areas also provide seasonal food and cover for migrating deer and elk.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management,

and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, brome grass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are sedges, wild strawberry, and heartleaf arnica.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are red alder, cottonwood, poplar, cherry, apple, hawthorn, and dogwood.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are Douglas fir, hemlock, and Pacific silver fir.

Shrubs are bushy woody plants that produce fruit,

buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are huckleberry, salal, and ceanothus.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are cattail, smartweed, wild millet, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include pheasant, meadowlark, quail, and rabbits.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, thrushes, woodpeckers, squirrels, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and

construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreation uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of

the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the

effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil

layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40

inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage

potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are

affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the

construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, a low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than

sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system (2) and the system adopted by the American Association of State Highway and Transportation Officials (1). Both systems are described in the "PCA Soil Primer" (24).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3

inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. No value is given for soils that formed in material having a high content of volcanic ash. The textures specified for these soils are apparent field textures. Because of the influence of the ash, a complete clay dispersion is not obtained in the laboratory and the reported clay values are low. The measured physical and chemical properties for these soils indicate a much higher content of clay than is reported by the laboratories.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $\frac{1}{3}$ bar moisture tension. Weight is determined after

drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Tables 16 and 17 give estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a

saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Cemented pans are cemented or indurated subsurface layers within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as thin or thick. A thin pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A thick pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 17 shows the expected initial subsidence, which usually is a result of

drainage, and total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (31). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Spodosol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthods (*Orth*, meaning true, plus *ods*, from Spodosols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplorthods (*Hapl*, meaning minimal horizonation, plus *orthods*, the suborder of the Spodosols that is most common).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplorthods.

FAMILY. Families are established within a subgroup

on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine loamy-skeletal, mixed, mesic Typic Haplorthods.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (29). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (31). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alderwood Series

The Alderwood series consists of moderately well drained soils formed in dense glacial till. These soils are moderately deep to ortstein. They are in glacially modified areas on foothills and in valleys. Slopes are 6

to 30 percent. The average annual precipitation is 35 to 50 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 190 to 210 days.

These soils are loamy-skeletal, mixed, mesic, ortstein Aquic Haplorthods.

Typical pedon of Alderwood gravelly loam, 6 to 15 percent slopes, in King County, about 5 miles southeast of Issaquah, 1,300 feet east and 2,200 feet north of the southwest corner of sec. 24, T. 23 N., R. 6 E.

Oa—1.5 inches to 0; decomposed needles and leaves.

A—0 to 1 inch; dark brown (10YR 3/3) gravelly loam, yellowish brown (10YR 5/4) dry; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; few very fine and common coarse roots; few very fine irregular pores; about 30 percent pebbles; strongly acid; clear smooth boundary.

Bs1—1 to 6 inches; dark brown (10YR 4/3) gravelly loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine and few fine roots; few fine irregular pores; about 30 percent pebbles; moderately acid; clear wavy boundary.

Bs2—6 to 12 inches; dark yellowish brown (10YR 3/4) very gravelly loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine irregular pores; about 35 percent pebbles; moderately acid; clear wavy boundary.

Bs3—12 to 20 inches; dark yellowish brown (10YR 3/4) very gravelly loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and common medium and coarse roots; common very fine and few fine irregular pores; about 35 percent pebbles and 10 percent cobbles; strongly acid; clear wavy boundary.

BC—20 to 33 inches; dark yellowish brown (10YR 4/4) very gravelly sandy loam, light olive brown (2.5Y 5/4) dry; massive; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common fine irregular pores; about 40 percent pebbles and 10 percent cobbles; moderately acid; abrupt smooth boundary.

Bsm—33 to 38 inches; grayish brown (2.5Y 5/2) ortstein that crushes to very gravelly sandy loam, light gray (2.5Y 7/2) dry; massive; very hard, firm, slightly sticky and slightly plastic; common medium and many coarse roots; common fine and medium irregular pores; about 35 percent pebbles and 10

percent cobbles; strongly acid; abrupt smooth boundary.

Cd—38 to 60 inches; grayish brown (2.5Y 5/2), dense glacial till that crushes to very gravelly sandy loam, light gray (2.5Y 7/1) dry; massive; very hard, firm, slightly sticky and slightly plastic; common fine and medium pores; about 25 percent pebbles and 10 percent cobbles; strongly acid.

The depth to ortstein ranges from 20 to 40 inches. The thickness of the solum ranges from 18 to 30 inches. The content of rock fragments in the particle-size control section ranges from 35 to 50 percent. It includes 0 to 10 percent cobbles.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and chroma of 3 or 4 when moist and dry.

The Bs horizon has value of 3 or 4 when moist and 4 to 6 when dry and chroma of 3 or 4 when moist and dry. It is gravelly loam, very gravelly loam, or very gravelly sandy loam.

The BC horizon has hue of 10YR or 2.5Y, value of 5 to 7 when dry, and chroma of 2 to 4 when moist and dry. It is very gravelly loam or very gravelly sandy loam.

The Bsm and Cd horizons are ortstein and dense glacial till, respectively. They crush to very gravelly loam or very gravelly sandy loam. They have value of 4 or 5 when moist and 6 or 7 when dry and chroma of 1 or 2 when moist and dry.

Alkiridge Series

The Alkiridge series consists of moderately well drained soils formed in volcanic ash and pumice over dense glacial till. These soils are moderately deep to dense glacial till. They are in cirque basins and on valley floors. Slopes are 8 to 30 percent. Elevation is 2,700 to 3,700 feet. The average annual precipitation is 70 to 90 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 110 to 130 days.

These soils are ashy over loamy-skeletal Typic Cryorthods.

Typical pedon of Alkiridge sandy loam, 8 to 30 percent slopes, in Pierce County, about 1 mile southwest of Frog Mountain along Forest Service Road 1819B, 900 feet south and 2,600 feet east of the northwest corner of sec. 14, T. 18 N., R. 8 E.

Oi&Oe—1 inch to 0; fresh and partially decomposed, loose forest litter, including needles, moss, bark, and old roots.

A1—0 to 1 inch; very dark gray (10YR 3/1) loamy sand (volcanic ash), dark gray (10YR 4/1) dry; single

grain; loose, nonsticky and nonplastic; weakly smeary; many very fine and fine and common medium and coarse roots; about 5 percent hard subangular pebbles and 10 percent hard cinders; strongly acid; abrupt wavy boundary.

A2—1 to 7 inches; dark brown (10YR 3/3) sandy loam (volcanic ash), brown (10YR 5/3) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine, common fine, and few coarse and medium roots; about 10 percent hard subangular pebbles and 10 percent hard cinders; moderately acid; abrupt smooth boundary.

Bhs—7 to 18 inches; dark brown (7.5YR 3/4) gravelly sandy loam, strong brown (7.5YR 5/6) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and few fine roots; about 20 percent hard subangular pebbles and 5 percent hard cinders; moderately acid; clear wavy boundary.

2BC1—18 to 28 inches; dark yellowish brown (10YR 4/4) very gravelly loam, very pale brown (10YR 7/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine and few fine roots; about 30 percent subangular pebbles and 5 percent cobbles; slightly acid; clear wavy boundary.

2BC2—28 to 37 inches; olive brown (2.5Y 4/4) very gravelly loam, pale yellow (2.5Y 7/4) dry; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; about 40 percent subangular pebbles and 10 percent cobbles; slightly acid; clear smooth boundary.

2Cd—37 inches; brown (10YR 4/3), dense glacial till that breaks to very gravelly sandy loam, pale brown (10YR 6/3) dry; massive; hard, firm, slightly sticky and slightly plastic; weakly smeary; about 40 percent hard subangular pebbles, 10 percent cobbles, and 5 percent stones; slightly acid.

The depth to dense glacial till is 20 to 40 inches. The spodic horizon is 8 to 11 inches thick. The particle-size control section ranges from 35 to 60 percent coarse fragments and 5 to 10 percent hard cinders.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry and chroma of 1 to 3 when moist and dry. It is more than 60 percent coarse volcanic ash. Reaction is strongly acid or moderately acid.

The Bhs horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 to 6 when moist and dry. It is gravelly sandy loam or very gravelly sandy loam and contains coarse volcanic

ash. It is 20 to 30 percent pebbles, 0 to 5 percent cobbles, and 0 to 10 percent hard cinders. Reaction is strongly acid or moderately acid.

The 2BC horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 4 to 6 when moist and dry. It is 30 to 40 percent pebbles and 5 to 10 percent cobbles. Reaction is moderately acid or slightly acid.

The 2Cd horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. When crushed, it is very gravelly loam or very gravelly sandy loam. It is 30 to 40 percent pebbles, 10 to 15 percent cobbles, and 5 to 10 percent stones.

Altapeak Series

The Altapeak series consists of deep, well drained soils formed in volcanic ash and pumice mixed with residuum and colluvium over granitic and metamorphic rocks. These soils are on mountain slopes. Slopes are 8 to 90 percent. Elevation is 3,600 to 5,600 feet. The average annual precipitation is 80 to 130 inches, and the mean annual air temperature is about 40 degrees F. The frost-free period is 90 to 110 days.

These soils are sandy-skeletal, mixed Typic Cryorthods.

Typical pedon of Altapeak gravelly sandy loam, 8 to 30 percent slopes, in King County, about 200 feet west of a spur on Forest Service Road 2291A, 1,000 feet south and 900 feet east of the northwest corner of sec. 28, T. 22 N., R. 10 E.

Oi—3 to 2 inches; loose forest litter, including needles, twigs, bark, and moss.

Oa—2 inches to 0; black (10YR 2/1), highly decomposed organic material that is matted and bound by roots; abrupt wavy boundary.

E—0 to 2 inches; pinkish gray (7.5YR 6/2) loamy sand (volcanic ash and pumice), light gray (N 7/0) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine roots; many very fine and fine interstitial pores; NaF pH 9.2; very strongly acid; abrupt wavy boundary.

Bhs—2 to 16 inches; dark reddish brown (2.5YR 2/4) and yellowish red (5YR 5/8) very gravelly sandy loam that has a mixture of volcanic ash and pumice; strong brown (7.5YR 5/6) and reddish brown (5YR 4/4) dry; moderate medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine and common medium and coarse roots; many very fine and fine interstitial pores; about 15 percent

cobbles and 20 percent pebbles and hard cinders; NaF pH 12.0; moderately acid; clear irregular boundary.

- Bs—16 to 24 inches; strong brown (7.5YR 5/6) very cobbly loamy sand, reddish yellow (7.5YR 6/6) dry; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine and few medium and coarse roots; many very fine and fine interstitial pores; about 20 percent cobbles and 20 percent pebbles; NaF pH 12.0+; moderately acid; clear smooth boundary.
- 2C1—24 to 33 inches; pale yellow (2.5Y 7/4) extremely cobbly loamy sand, very pale brown (10YR 7/3) dry; massive; hard, friable, slightly sticky and nonplastic; nonsmeary; common fine roots; common very fine and fine interstitial pores; about 15 percent pebbles and 45 percent cobbles; NaF pH 11.5; moderately acid; gradual smooth boundary.
- 2C2—33 to 50 inches; grayish brown (2.5Y 5/2) extremely gravelly coarse sand, light brownish gray (2.5Y 6/2) dry; massive; hard, friable; nonsmeary; few fine roots; about 45 percent pebbles and 25 percent cobbles; NaF pH 11.5; slightly acid; gradual irregular boundary.
- 2Cr—50 inches; grayish brown (2.5Y 5/2), highly weathered granodiorite that breaks to very gravelly coarse sand; light brownish gray (2.5Y 6/2) dry; can be dug by a spade with difficulty; about 65 percent hard pebbles; slightly acid.

The depth to paralithic contact is 40 to 60 inches. The content of rock fragments, including hard cinders, in the control section ranges from 35 to 70 percent by volume. Bedrock is granitic rock or low-grade metamorphic rock, including slate and phyllite.

The E horizon has hue of 5YR or 7.5YR or is neutral in hue. It has value of 5 to 7 when moist and 6 or 7 when dry and chroma of 0 to 2 when moist and dry. Reaction is strongly acid or very strongly acid.

The Bhs horizon has hue of 2.5YR or 5YR when moist and 5YR or 7.5YR when dry, value of 2 to 5 when moist and 4 or 5 when dry, and chroma of 4 to 8 when moist and 4 to 6 when dry. It is sandy loam or loam in the fine-earth fraction. It has 15 to 45 percent coarse fragments, including hard cinders.

The Bs horizon has value of 4 or 5 when moist and 5 or 6 when dry and chroma of 4 to 6 when moist and dry. It is very cobbly loamy sand, very gravelly loamy sand, or very gravelly sandy loam. Reaction is slightly acid to strongly acid.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 when moist and dry, and chroma of 2 to 4 when moist and 2 or 3 when dry. It is loamy sand, coarse

sand, or loamy coarse sand in the fine-earth fraction. It has 45 to 75 percent coarse fragments by volume. Reaction is slightly acid to strongly acid.

Andic Cryumbrepts

Andic Cryumbrepts consist of moderately deep to very deep, well drained soils formed in volcanic ash, glacial till, and colluvium derived from basalt and andesite. They are on cirque sidewalls. Slopes are 30 to 90 percent. Elevation is 4,000 to 6,500 feet. The average annual precipitation is 80 to 120 inches, and the mean annual air temperature is about 40 degrees F. The frost-free period is 90 to 110 days.

Typical pedon of Andic Cryumbrepts, 30 to 90 percent slopes, in King County, about 1 mile north of Blowout Mountain, 2,200 feet east and 1,200 feet north of the southwest corner of sec. 11, T. 19 N., R. 12 E.

- Oi—0.5 inch to 0; undecomposed needles, leaves, and twigs.
- A—0 to 5 inches; very dark grayish brown (10YR 3/2) very gravelly sandy loam, grayish brown (10YR 5/2) dry; weak very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine roots; many very fine irregular pores; about 50 percent pebbles; strongly acid; clear smooth boundary.
- Bw1—5 to 16 inches; dark yellowish brown (10YR 3/4) very gravelly sandy loam, yellowish brown (10YR 5/4) dry; weak very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine roots; many fine irregular pores; about 50 percent pebbles; strongly acid; diffuse smooth boundary.
- Bw2—16 to 44 inches; dark brown (7.5YR 3/4) extremely gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many fine irregular pores; about 60 percent pebbles; strongly acid; abrupt smooth boundary.
- R—44 inches; andesite.

The depth to bedrock is 20 to 60 inches. The content of rock fragments in the particle-size control section ranges from 25 to 75 percent. The umbric epipedon is 7 to 15 inches thick.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist and dry. The Bw horizon has hue of

7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is gravelly loam, very gravelly loam, very gravelly sandy loam, or extremely gravelly sandy loam.

Arents

Arents consist of moderately deep to very deep, moderately well drained to somewhat excessively drained soils formed in a mixture of volcanic ash and a variety of glacial deposits. They are on terraces and drift plains. Slopes are 0 to 8 percent. Elevation is 1,000 to 3,000 feet. The average annual precipitation is 40 to 95 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 100 to 150 days.

Typical pedon of Arents, 0 to 8 percent slopes, in King County, about 3.5 miles southeast of Enumclaw, 900 feet east and 1,600 feet south of the northwest corner of sec. 28, T. 20 N., R. 7 E.

C1—0 to 35 inches; about 80 percent gravelly sandy loam that is dominantly dark yellowish brown (10YR 4/4) but is variegated and 20 percent dark brown (7.5YR 4/4) very gravelly loam; very pale brown (10YR 7/4) and light brown (7.5YR 6/4) dry; massive; loose, nonsticky and nonplastic; about 30 percent pebbles and 5 percent cobbles; moderately acid; gradual smooth boundary.

C2—35 to 60 inches; dark yellowish brown (10YR 4/4) extremely gravelly sand, very pale brown (10YR 7/4) dry; single grain; loose; many medium irregular pores; about 60 percent pebbles and 10 percent cobbles; moderately acid.

The content of rock fragments in the particle-size control section ranges from 20 to 70 percent. The depth to dense glacial till ranges from 30 to more than 60 inches. The soils are gravelly sandy loam to extremely gravelly coarse sand. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 2 to 6 when moist and dry.

Barneston Series

The Barneston series consists of very deep, somewhat excessively drained soils formed in a mixture of volcanic ash and glacial outwash. These soils are on terraces and terrace escarpments. Slopes are 0 to 65 percent. Elevation is 500 to 1,400 feet. The average annual precipitation is 50 to 75 inches, and the mean annual air temperature is about 48 degrees F. The frost-free period is 160 to 190 days.

These soils are sandy-skeletal, mixed, mesic Typic Haplorthods.

Typical pedon of Barneston gravelly coarse sandy loam, 6 to 30 percent slopes, in Pierce County, about 6.5 miles southwest of Orting, 2,200 feet south and 2,300 feet west of the northeast corner of sec. 27, T. 18 N., R. 5 E.

Oi—2 inches to 1 inch; undecomposed needles, leaves, and twigs; about 20 percent pebbles.

Oa—1 inch to 0; black (10YR 2/1), decomposed roots, needles, and twigs; about 20 percent pebbles.

E—0 to 9 inches; dark grayish brown (10YR 4/2) gravelly coarse sandy loam, light gray (10YR 7/2) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine and few medium and coarse roots; many fine irregular pores; about 30 percent pebbles; strongly acid; clear smooth boundary.

Bs—9 to 14 inches; dark yellowish brown (10YR 3/4) very gravelly sandy loam, pale brown (10YR 6/3) dry; single grain; loose; many very fine and fine, common medium, and few coarse roots; many fine irregular pores; about 30 percent pebbles and 10 percent cobbles; strongly acid; clear smooth boundary.

2CB—14 to 21 inches; dark brown (7.5YR 4/4) and dark yellowish brown (10YR 4/4) extremely gravelly sand, very pale brown (10YR 7/4) dry; single grain; loose; common fine and few coarse roots; many medium irregular pores; about 50 percent pebbles and 20 percent cobbles; strongly acid; gradual smooth boundary.

2C—21 to 60 inches; dark yellowish brown (10YR 4/4) extremely gravelly sand, very pale brown (10YR 7/4) dry; single grain; loose; many medium irregular pores; about 60 percent pebbles and 20 percent cobbles; strongly acid.

The thickness of the solum is 14 to 25 inches. The content of rock fragments in the particle-size control section ranges from 50 to 70 percent.

The E horizon has value of 2 to 4 when moist and 5 to 7 when dry and chroma of 1 to 3 when moist and dry. The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is very gravelly sandy loam or very gravelly sand.

The 2CB horizon has hue of 7.5YR, 10YR, or 2.5Y, and the 2C horizon has hue of 10YR or 2.5Y. Both horizons have value of 4 or 5 when moist and 5 to 7 when dry and chroma of 2 to 4 when moist and dry. They are extremely gravelly sand or extremely gravelly loamy sand.

Beausite Series

The Beausite series consists of well drained soils formed in glacial till and colluvium derived dominantly from sandstone. These soils are moderately deep to sandstone. They are on foothills. Slopes are 6 to 90 percent. Elevation is 600 to 1,500 feet. The average annual precipitation is 30 to 50 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 180 to 210 days.

These soils are loamy-skeletal, mixed, mesic Typic Haplorthods.

Typical pedon of Beausite gravelly loam, 30 to 65 percent slopes, in King County, about 3.5 miles northeast of Maple Valley, 2,300 feet north and 2,700 feet east of the southwest corner of sec. 31, T. 23 N., R. 7 E.

Oi&Oa—2 inches to 0; fresh and partially decomposed duff and litter.

A—0 to 5 inches; black (10YR 2/1) gravelly loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; slightly hard, friable, nonsticky and slightly plastic; weakly smeary; many very fine and fine roots; many very fine irregular pores; about 30 percent pebbles; moderately acid; abrupt smooth boundary.

AB—5 to 11 inches; dark brown (10YR 3/3) very gravelly sandy loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine irregular pores; about 50 percent pebbles; moderately acid; clear wavy boundary.

Bs1—11 to 21 inches; dark brown (7.5YR 4/4) extremely gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine irregular pores; about 55 percent pebbles and 25 percent cobbles; moderately acid; gradual wavy boundary.

Bs2—21 to 29 inches; dark yellowish brown (10YR 4/4) extremely gravelly sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and medium roots; many fine irregular pores; about 65 percent pebbles and 15 percent cobbles; moderately acid; gradual smooth boundary.

BC—29 to 36 inches; light olive brown (2.5Y 5/4) extremely gravelly sandy loam, white (2.5Y 8/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; few medium and coarse roots; many fine

irregular pores; about 70 percent pebbles; moderately acid; abrupt irregular boundary.
R—36 inches; sandstone.

The depth to bedrock ranges from 24 to 40 inches. The content of rock fragments in the particle-size control section ranges from 50 to 70 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 1 or 2 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 to 7 when dry, and chroma of 3 or 4 when moist and dry. It is very gravelly sandy loam, very gravelly loam, or extremely gravelly sandy loam.

The BC horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 to 8 when dry, and chroma of 3 or 4 when moist and dry. It is extremely gravelly loam or extremely gravelly sandy loam.

Belfast Series

The Belfast series consists of very deep, moderately drained soils formed in alluvium. These soils are on terraces. Slopes are 0 to 2 percent. Elevation is 50 to 120 feet. The average annual precipitation is 50 to 60 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 160 to 180 days.

These soils are coarse-loamy, mixed, nonacid, mesic Aquic Xerofluvents.

Typical pedon of Belfast silt loam, 0 to 2 percent slopes, in King County, about 4 miles south of Carnation, 1,000 feet north and 1,800 feet west of the southeast corner sec. 4, T. 24 N., R. 7 E.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine roots; many coarse and common fine irregular and common coarse tubular pores; moderately acid; clear smooth boundary.

C1—7 to 16 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; many coarse and common fine irregular and common coarse tubular pores; moderately acid; gradual smooth boundary.

C2—16 to 25 inches; brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common

very fine roots; many coarse and common fine irregular and common coarse tubular pores; slightly acid; gradual smooth boundary.

C3—25 to 38 inches; pale brown (10YR 6/3) fine sandy loam, very pale brown (10YR 7/3) dry; massive; soft, friable, slightly sticky and slightly plastic; few very fine roots; many coarse and common fine irregular and common coarse tubular pores; slightly acid; clear smooth boundary.

C4—38 to 55 inches; grayish brown (2.5Y 5/2), stratified fine sandy loam (70 percent) and loamy fine sand (30 percent), light gray (2.5Y 7/2) dry; massive; soft, very friable, nonsticky and nonplastic; common fine irregular pores; slightly acid; clear smooth boundary.

C5—55 to 60 inches; grayish brown (10YR 5/2), stratified fine sandy loam (60 percent) and loamy fine sand (40 percent), light gray (10YR 7/2) dry; massive; soft, very friable, nonsticky and nonplastic; common fine irregular pores; slightly acid.

The content of clay in the control section ranges from 5 to 15 percent.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry and chroma of 2 or 3 when moist and dry. The C1 and C2 horizons have value of 4 to 6 when moist and 6 or 7 when dry. They are silt loam, fine sandy loam, or very fine sandy loam. The C3, C4, and C5 horizons have hue of 10YR or 2.5Y, value of 5 or 6 when moist and 6 or 7 when dry, and chroma of 2 or 3 when moist and dry. They are stratified very fine sandy loam to loamy sand.

Bellicum Series

The Bellicum series consists of deep, well drained soils formed in a mantle of pumice and volcanic ash over residuum and colluvium derived dominantly from porphyritic andesite. These soils are on mountain back slopes. Slopes are 8 to 65 percent. Elevation is 1,800 to 2,800 feet. The average annual precipitation is 70 to 90 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 150 to 170 days.

These soils are cindery over medial-skeletal, frigid Typic Haplorthods.

Typical pedon of Bellicum very cindery loamy sand, 30 to 65 percent slopes, in Pierce County, about 5.5 miles south of Fairfax, 500 feet west and 1,500 feet north of the southeast corner of sec. 26, T. 17 N., R. 6 E.

Oi&Oa—1 inch to 0; fresh and partially decomposed needles, leaves, and twigs.

E—0 to 1 inch; dark grayish brown (10YR 4/2) cindery

loamy sand, light brownish gray (10YR 6/2) dry; single grain; loose; many very fine and fine and common medium and coarse roots; many fine irregular pores; about 10 percent pumice and cinders 2 to 5 millimeters in diameter; strongly acid; abrupt wavy boundary.

Bs1—1 to 12 inches; variegated 70 percent strong brown (7.5YR 5/6) and 30 percent grayish brown (10YR 5/2) very cindery loamy sand, reddish yellow (7.5YR 6/6) and light brownish gray (10YR 6/2) dry; single grain; loose; many very fine and fine and common medium and coarse roots; many fine irregular pores; about 40 percent pumice and cinders 2 to 5 millimeters in diameter; strongly acid; clear wavy boundary.

Bs2—12 to 21 inches; variegated 80 percent yellowish red (5YR 5/6) and 20 percent grayish brown extremely cindery loamy sand, reddish yellow (7.5YR 6/6) and light brownish gray (10YR 6/2) dry; single grain; loose; common very fine and fine and few medium and coarse roots; many fine irregular pores; about 60 percent pumice and cinders 2 to 5 millimeters in diameter and 5 percent pebbles; moderately acid; abrupt wavy boundary.

2Bsb—21 to 39 inches; dark yellowish brown (10YR 3/4) very cobbly sandy loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; few very fine, fine, and medium roots; many very fine irregular pores; about 40 percent cobbles and 15 percent pebbles; moderately acid; clear wavy boundary.

2C—39 to 52 inches; dark yellowish brown (10YR 4/4) extremely cobbly sandy loam, light yellowish brown (10YR 6/4) dry; massive; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine irregular pores; about 40 percent cobbles and 30 percent pebbles; moderately acid; clear wavy boundary.

3R—52 inches; fractured andesite.

The depth to bedrock is 40 to 60 inches. The thickness of the cindery material is 18 to 24 inches. The content of pumice and cinders averages 50 percent in the upper part of the particle-size control section and ranges from 60 to 75 percent in the lower part.

The E horizon has hue of 7.5YR or 10YR and value of 3 or 4 when moist and 6 or 7 when dry. The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 to 6 when moist and dry. The 2Bsb and 2C horizons have hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. The 2Bs horizon is very cobbly loam or very cobbly

sandy loam. The 2C horizon is very cobbly loam, very cobbly sandy loam, or extremely cobbly sandy loam.

Blethen Series

The Blethen series consists of very deep, well drained soils formed in colluvium and slope alluvium derived from glacial drift. The alluvium and colluvium have an admixture of volcanic ash. These soils are on mountain back slopes, side slopes, and toe slopes and on drift plain escarpments. Slopes are 5 to 65 percent. Elevation is 500 to 1,800 feet. The average annual precipitation is 55 to 75 inches, and the mean annual air temperature is about 47 degrees F. The frost-free period is 150 to 170 days.

These soils are loamy-skeletal, mixed, mesic Typic Haplorthods.

Typical pedon of Blethen gravelly loam, 30 to 65 percent slopes, in King County, about 4 miles west of Cedar Lake, 1,440 feet west and 400 feet north of the southeast corner of sec. 6, T. 22 N., R. 8 E.

Oi—5 to 2 inches; needles, leaves, and twigs.

Oa—2 inches to 0; decomposed forest litter; abrupt smooth boundary.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) gravelly loam, dark brown (10YR 4/3) dry; moderate very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium roots; many very fine interstitial pores; about 25 percent subrounded pebbles; NaF pH 10.5; strongly acid; clear smooth boundary.

Bs1—5 to 13 inches; dark brown (10YR 4/3) very gravelly loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; common fine and medium roots; many very fine interstitial pores; about 40 percent subrounded pebbles; NaF pH 12.0+; moderately acid; clear smooth boundary.

Bs2—13 to 24 inches; dark brown (7.5YR 4/4) very gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; many very fine interstitial pores; about 40 percent subrounded pebbles and 5 percent cobbles; NaF pH 12.0+; moderately acid; gradual wavy boundary.

Bs3—24 to 42 inches; dark yellowish brown (10YR 4/4) extremely gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak very fine subangular blocky structure; soft; very friable, nonsticky and

nonplastic; weakly smeary; few fine and medium roots; many very fine interstitial pores; about 60 percent subrounded pebbles and 10 percent cobbles; NaF pH 11.5; moderately acid; clear smooth boundary.

C—42 to 60 inches; yellowish brown (10YR 5/4) extremely gravelly loamy sand, very pale brown (10YR 7/4) dry; loose, nonsticky and nonplastic; few fine roots; many very fine interstitial pores; about 65 percent subrounded pebbles and 15 percent cobbles; NaF pH 11.5; moderately acid.

The solum is 15 to 50 inches thick. The content of rock fragments in the control section is 35 to 70 percent by volume. Reaction is strongly acid to slightly acid throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5 when moist and 4 to 7 when dry, and chroma of 2 or 3 when moist and 2 to 4 when dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 to 6 when moist and dry. Moist value and chroma of 3 do not occur together. This horizon is loam, silt loam, or sandy loam in the fine-earth fraction. It has 25 to 60 percent rock fragments in the upper part and 40 to 70 percent in the lower part.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 to 6 when moist and dry. The fine-earth fraction is sandy loam or loam within a depth of 40 inches and sandy loam, loam, or loamy sand below that depth. It has 40 to 70 percent pebbles, 5 to 25 percent cobbles, and 0 to 10 percent stones by volume.

Borohemists

Borohemists consist of very deep, very poorly drained soils formed in partially decomposed herbaceous plant material over decomposed woody material that has varying amounts of alluvium or mudflow deposits. They are in depressions on river terraces and mountains. Slopes are 0 to 2 percent. Elevation is 1,400 to 2,800 feet. The average annual precipitation is 60 to 90 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 150 to 170 days.

Typical pedon of Borohemists, 0 to 2 percent slopes, in Pierce County, about 5 miles west of Golden Lakes, in Mt. Rainier National Park, 700 feet east and 600 feet south of the northwest corner of sec. 12, T. 16 N., R. 6 E.

Oe1—0 to 4 inches; very dark brown (10YR 2/2) mucky peat, very dark grayish brown (10YR 3/2) dry;

moderate medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many fine irregular pores; about 50 percent fiber before rubbing and 25 percent after rubbing; very strongly acid; abrupt smooth boundary.

Oe2—4 to 30 inches; very dark grayish brown (10YR 3/2) hemic material, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; common fine, medium, and coarse roots; many fine irregular pores; about 40 percent fiber before rubbing and 20 percent after rubbing; very strongly acid; abrupt smooth boundary.

C—30 to 34 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; many fine irregular pores; strongly acid; abrupt smooth boundary.

O'e—34 to 60 inches; dark reddish brown (5YR 3/3) hemic material, reddish brown (5YR 4/3) dry; moderate medium granular structure; slightly hard, friable, nonsticky and nonplastic; many fine irregular pores; about 80 percent fiber before rubbing and 45 percent after rubbing; very strongly acid.

The hemic material is 20 to more than 60 inches thick. The fiber in this material is derived mainly from grasses and sedges, but some pedons contain as much as 10 percent wood fragments. The content of fiber ranges from 50 to 80 percent before rubbing and from 20 to 50 percent after rubbing.

The Oe horizon has hue of 5YR, 7.5YR, or 10YR, value of 2 or 3 when moist and 2 to 4 when dry, and chroma of 2 or 3 when moist and dry. The C horizon, if it occurs, has hue of 10YR, 2.5Y, or 5Y, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 1 or 2 when moist and dry. It is loam, silt loam, or sandy loam.

Bromo Series

The Bromo series consists of very deep, well drained soils formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from andesite. These soils are on mountain back slopes. Slopes are 30 to 65 percent. Elevation is 1,800 to 2,800 feet. The average annual precipitation is 70 to 90 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 155 to 175 days.

These soils are cindery over medial, frigid Typic Haplorthods.

Typical pedon of Bromo very cindery sandy loam, 30 to 65 percent slopes, in Pierce County, about 2.5 miles west of Nisqually Park Ranger Station, 1,800 feet north

and 900 feet west of the southeast corner of sec. 30, T. 15 N., R. 7 E.

Oi—2 inches to 0; undecomposed needles, twigs, and leaves.

A—0 to 4 inches; very dark brown (10YR 2/2) very cindery sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine irregular pores; about 40 percent pumice 2 to 5 millimeters in diameter; moderately acid; clear smooth boundary.

AB—4 to 13 inches; about 80 percent dark brown (10YR 3/3) and 20 percent light brownish gray (10YR 6/2) very cindery loamy sand, 80 percent brown (10YR 5/3) and 20 percent light gray (10YR 7/2) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine irregular pores; about 40 percent pumice 2 to 5 millimeters in diameter; moderately acid; clear wavy boundary.

Bs1—13 to 23 inches; about 50 percent yellowish red (5YR 5/6), 30 percent strong brown (7.5YR 5/8), and 20 percent light brownish gray (10YR 6/2) very cindery sand, 80 percent reddish yellow (7.5YR 6/6) and 20 percent light gray (10YR 7/2) dry; single grain; loose; common very fine, fine, and medium roots; many very fine irregular pores; about 40 percent pumice 2 to 5 millimeters in diameter; thin layers of dark brown (10YR 3/3) material 0.25 to 1 inch thick; moderately acid; clear wavy boundary.

Bs2—23 to 29 inches; about 80 percent reddish yellow (7.5YR 6/8) and 20 percent light brownish gray (10YR 6/2) very cindery sand, 80 percent yellow (10YR 7/6) and 20 percent light gray (10YR 7/2) dry; single grain; loose; common very fine and fine roots; many very fine irregular pores; about 50 percent pumice 2 to 5 millimeters in diameter; thin layers of dark brown (10YR 3/3) material 0.25 to 1 inch thick; moderately acid; abrupt smooth boundary.

Bs3—29 to 32 inches; about 50 percent reddish yellow (7.5YR 6/8) and 50 percent light gray (10YR 7/2) very cindery sand, 50 percent yellow (10YR 8/6) and 50 percent very pale brown (10YR 8/4) dry; single grain; loose; few very fine roots; many very fine irregular pores; about 50 percent pumice 2 to 5 millimeters in diameter; slightly acid; abrupt wavy boundary.

2CBb—32 to 55 inches; dark brown (7.5YR 4/4) sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary;

few very fine roots; common very fine irregular pores; about 5 percent pebbles; slightly acid; clear smooth boundary.

2Cb—55 to 60 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; massive; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine irregular pores; about 5 percent pebbles; slightly acid.

Depth to the buried part of the profile is 20 to 35 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry. The AB horizon has hue of 7.5YR or 10YR and chroma of dominantly 2 or 3 when moist and dry. It is very cindery sandy loam or very cindery loamy sand. The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 7 when moist and 6 to 8 when dry, and chroma of 2 to 8 when moist and dry. The 2CB and 2C horizons have hue of 7.5YR or 10YR and chroma of 3 or 4 when moist and dry. They are loam or sandy loam.

Cattcreek Series

The Cattcreek series consists of very deep, well drained soils formed in dacitic pumice and volcanic ash over residuum and colluvium derived dominantly from andesite. In some areas these soils are underlain by glacial till or sandstone. They are on mountain back slopes and in cirque basins. Slopes are 8 to 90 percent. Elevation is 2,800 to 5,300 feet. The average annual precipitation is 95 to 115 inches, and the mean annual air temperature is about 39 degrees F. The frost-free period is 110 to 120 days.

These soils are cindery over medial-skeletal Typic Cryorthods.

Typical pedon of Cattcreek very cindery loamy sand, 30 to 65 percent slopes, in Pierce County, about 1.5 miles northwest of Nisqually Park Ranger Station, 1,600 feet west and 530 feet south of the northeast corner of sec. 29, T. 15 N., R. 7 E.

Oi—3 to 2 inches; undecomposed leaf litter.

Oa—2 inches to 0; black (10YR 2/1), decomposed leaf litter.

E—0 to 3 inches; dark brown (7.5YR 3/2) cindery loamy sand, brown (7.5YR 5/2) dry; weak fine subangular blocky structure; loose, very friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many fine irregular pores; few pebbles; moderately acid; abrupt wavy boundary.

Bs1—3 to 7 inches; dark brown (7.5YR 3/4) very cindery loamy sand, brown (7.5YR 5/4) dry; weak fine subangular blocky structure; loose, very friable, nonsticky and nonplastic; many very fine and fine

and few medium and coarse roots; many fine irregular pores; few pebbles; moderately acid; clear smooth boundary.

Bs2—7 to 11 inches; strong brown (7.5YR 4/6) very cindery loamy sand, strong brown (7.5YR 5/6) dry; weak fine subangular blocky structure; loose, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many fine irregular pores; few pebbles; moderately acid; clear smooth boundary.

Bs3—11 to 21 inches; variegated strong brown (7.5YR 4/6) and pinkish gray (7.5YR 7/2) very cindery sand, strong brown (7.5YR 5/6) and pinkish white (7.5YR 8/2) dry; single grain; loose; common very fine and fine and few coarse roots; many fine irregular pores; few pebbles; slightly acid; abrupt wavy boundary.

2Bsb1—21 to 25 inches; dark yellowish brown (10YR 4/6) very gravelly sandy loam, yellowish brown (10YR 5/6) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine roots; many very fine irregular pores; about 35 percent pebbles; slightly acid; gradual smooth boundary.

2Bsb2—25 to 60 inches; olive brown (2.5Y 4/4) very gravelly sandy loam, light olive brown (2.5Y 5/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; common very fine irregular pores; about 45 percent pebbles; slightly acid.

The thickness of the cindery material is 15 to 30 inches. The content of rock fragments ranges from 0 to 10 percent in the upper part of the particle-size control section and from 35 to 55 percent in the lower part.

The E horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist and dry.

The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5 when moist and 5 to 8 when dry, and chroma of 2 to 6 when moist and dry. It is very cindery loamy sand or very cindery sand.

The 2Bsb horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 2 to 6 when moist and dry. It is very gravelly sandy loam, very gravelly loam, very gravelly silt loam, extremely gravelly sandy loam, extremely gravelly loam, or extremely gravelly silt loam.

Cayuse Series

The Cayuse series consists of very deep, well drained soils formed in volcanic ash and pumice over

residuum and colluvium derived from andesite or basalt. These soils are on mountain ridge crests and side slopes. Slopes are 8 to 90 percent. Elevation is 5,000 to 6,200 feet. The average annual precipitation is 80 to 100 inches, and the mean annual air temperature is about 38 degrees F. The frost-free period is 85 to 105 days.

These soils are ashy over medial Typic Cryandepts.

Typical pedon of Cayuse sandy loam, 8 to 30 percent slopes, in Pierce County, Corral Pass Campground, Snoqualmie National Forest, 2,340 feet east and 790 feet north of the southwest corner of sec. 30, T. 18 N., R. 11 E.

Oi—0.25 inch to 0; moss, twigs, needles.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) sandy loam (volcanic ash), dark brown (10YR 4/3) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and common fine roots; very strongly acid; NaF pH 12.0+; clear smooth boundary.

A2—4 to 13 inches; dark brown (10YR 3/3) sandy loam (volcanic ash), dark yellowish brown (10YR 4/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; many very fine, fine, and medium roots; about 10 percent fine pebbles; very strongly acid; NaF pH 12.0+; clear smooth boundary.

Bw1—13 to 30 inches; brown (7.5YR 4/4) loam (volcanic ash), brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; moderately smeary; common fine and medium roots; about 10 percent pebbles; strongly acid; NaF pH 11.5; clear smooth boundary.

2Bw2—30 to 36 inches; dark yellowish brown (10YR 4/6) gravelly loam, brownish yellow (10YR 6/6) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; few fine roots; about 30 percent hard pebbles and 10 percent soft pebbles; strongly acid; NaF pH 11.0; clear smooth boundary.

2C—36 to 60 inches; variegated dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) very gravelly loam, light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6) dry; moderate fine and medium angular and subangular blocky structure; hard, firm, slightly sticky and slightly plastic; moderately smeary; few fine roots; about 40 percent hard pebbles and 10 percent soft pebbles; strongly acid; NaF pH 10.5.

The mantle of volcanic ash is 14 to 35 inches thick.

Reaction is moderately acid to very strongly acid throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist and dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 4 to 6 when moist and dry. It is loam or sandy loam. It has 5 to 15 percent rock fragments by volume.

The 2Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is gravelly loam or gravelly sandy loam. It has 15 to 35 percent hard rock fragments by volume.

The 2C horizon has value of 4 or 5 when moist and 5 or 6 when dry and chroma of 4 to 6 when moist and dry. It is very gravelly loam, gravelly loam, or very gravelly sandy loam. It has 30 to 50 percent hard rock fragments by volume.

Chinkmin Series

The Chinkmin series consists of moderately well drained soils formed in a thin mantle of volcanic ash and pumice over colluvium derived from dense glacial till. These soils are moderately deep to ortstein. They are in cirques and valleys and on lateral moraines and drift plains in the mountains. Slopes are 0 to 70 percent. Elevation is 2,500 to 6,000 feet. The average annual precipitation is 90 to 100 inches, and the mean annual air temperature is about 40 degrees F. The frost-free period is 80 to 100 days.

These soils are loamy-skeletal, mixed, ortstein Typic Cryohumods.

Typical pedon of Chinkmin sandy loam, 0 to 15 percent slopes, in King County, about 20 feet east of Forest Service Road 2291, in the Hansen Creek drainage, 2,500 feet south and 1,200 feet west of the northeast corner of sec. 28, T. 22 N., R. 10 E.

Oi—3 to 2 inches; loose forest litter, including needles, twigs, bark, and moss.

Oa—2 inches to 0; black (10YR 2/1), highly decomposed organic material that is matted and bound by roots; abrupt smooth boundary.

E—0 to 3 inches; gray (10YR 6/1) loamy sand (volcanic ash and pumice), light gray (10YR 7/1) dry; single grain; loose; common very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; very strongly acid; abrupt wavy boundary.

Bhs1—3 to 8 inches; dark reddish brown (2.5YR 3/4) and yellowish red (5YR 4/6) sandy loam, dark reddish brown (5YR 3/3) dry; moderate medium subangular blocky structure; hard, firm, slightly

sticky and slightly plastic; moderately smeary; common very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; about 10 percent pebbles and shotlike aggregate; very strongly acid; clear irregular boundary.

Bhs2—8 to 15 inches; variegated strong brown (7.5YR 4/6) and reddish brown (5YR 4/4) gravelly loam, strong brown (7.5YR 5/8) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; common very fine and fine interstitial pores; about 20 percent pebbles and 10 percent cobbles; strongly acid; clear smooth boundary.

Bs—15 to 22 inches; brown (7.5YR 4/4) very cobbly loam, yellowish brown (10YR 5/8) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; common very fine and fine roots; many interstitial pores; about 20 percent pebbles and 30 percent cobbles; strongly acid; clear smooth boundary.

BC—22 to 32 inches; dark yellowish brown (10YR 3/4) very gravelly sandy loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; few very fine and fine roots; many interstitial pores; about 35 percent pebbles and 10 percent cobbles; strongly acid; abrupt smooth boundary.

2Bsm—32 to 60 inches; dark grayish brown (2.5Y 4/2) ortstein that breaks to extremely gravelly sandy loam, light gray (2.5Y 7/2) dry; common fine prominent reddish brown (5YR 4/4) stains or mottles; massive; very hard, extremely firm, nonsticky and nonplastic; about 45 percent subangular pebbles and 20 percent subangular cobbles; strongly acid.

The depth to ortstein ranges from 20 to 40 inches.

The E horizon has hue of 7.5YR or 10YR when moist and dry, value of 5 or 6 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry.

The Bhs1 horizon has hue of 2.5YR, 5YR, or 7.5YR when moist and dry, value of 2 to 4 when moist, and chroma of 4 to 6 when moist and 2 to 6 when dry. Reaction is very strongly acid to moderately acid.

The Bhs2 horizon has hue of 5YR or 7.5YR when moist and 7.5YR or 10YR when dry, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and 4 to 8 when dry. The content of rock fragments is 15 to 40 percent by volume. This horizon is gravelly loam, cobbly loam, very gravelly loam, gravelly silt loam, or gravelly fine sandy loam. Reaction is very strongly acid to moderately acid.

The Bs horizon has hue of 7.5YR or 10YR when moist and dry, value of 5 or 6 when dry, and chroma of 4 to 6 when moist and 4 to 8 when dry. The content of rock fragments is 35 to 60 percent by volume. These fragments include both gravel and cobbles. This horizon is very gravelly sandy loam, very cobbly sandy loam, very gravelly loam, very cobbly loam, or very cobbly fine sandy loam. Reaction is very strongly acid or strongly acid.

The BC horizon has hue of 5YR, 10YR, or 2.5Y, value of 3 or 4 when moist and 5 to 7 when dry, and chroma of 3 to 6 when moist and dry. It is very gravelly loam, very cobbly loam, very gravelly sandy loam, or very cobbly sandy loam. Reaction is very strongly acid or strongly acid.

The 2Bsm horizon has value of 4 or 5 when moist and 6 or 7 when dry and chroma of 2 to 6 when moist and dry. It is ortstein that formed in dense glacial till. It breaks to very gravelly loam, extremely gravelly loam, extremely gravelly sandy loam, or very cobbly sandy loam. The content of rock fragments is 40 to 75 percent.

Christoff Series

The Christoff series consists of very deep, moderately well drained soils formed in volcanic ash and cinders over highly weathered breccia and tuffaceous rocks. These soils are on mountain side slopes and in slump areas. Slopes are 6 to 65 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 60 to 80 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 135 to 155 days.

These soils are fine-loamy, mixed Eutric Glossoboralfs.

Typical pedon of Christoff sandy loam, 30 to 65 percent slopes, in King County, about 0.5 mile north of Greenwater, 1,400 feet north and 2,000 feet west of the southeast corner of sec. 3, T. 19 N., R. 9 E.

Oi—1 to 0.5 inch; leaves, needles, and twigs; abrupt smooth boundary.

Oa—0.5 inch to 0; decomposed organic litter; abrupt smooth boundary.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) sandy loam (volcanic ash), brown (10YR 5/3) dry; single grain; loose; many very fine and fine and common medium roots; about 2 percent pebbles and 3 percent hard cinders; strongly acid; clear smooth boundary.

E1—3 to 12 inches; brown (10YR 4/3) sandy loam (volcanic ash), very pale brown (10YR 7/3) dry; weak fine subangular blocky structure; soft, very

friable, slightly sticky and slightly plastic; moderately smeary; many very fine and fine and common medium and coarse roots; about 5 percent pebbles and 5 percent hard cinders; moderately acid; clear smooth boundary.

2E2—12 to 26 inches; dark yellowish brown (10YR 4/4) loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; moderately smeary; common very fine, fine, medium, and coarse roots; about 10 percent pebbles; moderately acid; clear wavy boundary.

2Bt1—26 to 42 inches; dark yellowish brown (10YR 4/4) loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; weakly smeary; few very fine and fine roots; about 5 percent pebbles; moderately acid; gradual smooth boundary.

2Bt2—42 to 60 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; weak coarse subangular blocky structure; hard, friable, sticky and plastic; about 10 percent pebbles; common thin clay films in pores and on faces of peds; moderately acid.

The A horizon has value of 3 or 4 when moist and chroma of 2 to 4 when moist and dry. Reaction is strongly acid or moderately acid.

The E horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 7 or 8 when dry, and chroma of 3 or 4 when moist and dry. It is sandy loam, gravelly sandy loam, loam, or gravelly loam. It has more than 60 percent volcanic ash and cinders. It has 5 to 10 percent hard cinders and 5 to 20 percent pebbles.

The 2E horizon has value of 4 or 5 when moist and 7 or 8 when dry and chroma of 3 or 4 when moist. It has 5 to 15 percent pebbles.

The 2Bt horizon has value of 4 or 5 when moist and chroma of 3 to 6 when moist and dry. It is loam or clay loam. It has 5 to 15 percent pebbles. It is highly weathered breccia exhibiting rock structure. The weathered pebbles cause a mottled appearance. Some pedons have mottles with hue of 7.5YR or 10YR and chroma of 1 to 3 when moist.

Chuckanut Series

The Chuckanut series consists of deep, well drained soils formed in a mixture of volcanic ash and colluvium derived from sandstone and glacial till. These soils are on back slopes and toe slopes in the foothills. Slopes are 6 to 65 percent. Elevation is 400 to 1,500 feet. The average annual precipitation is 35 to 45 inches, and the mean annual air temperature is about 49 degrees F. The frost-free period is 170 to 190 days.

These soils are coarse-loamy, mixed, mesic Typic Haplorthods.

Typical pedon of Chuckanut loam, 30 to 65 percent slopes, in King County, about 1 mile southwest of Ravensdale, 3,600 feet west and 1,500 feet north of the southeast corner of sec. 36, T. 22 N., R. 6 E.

Oa—1 inch to 0; undecomposed leaves, needles, and twigs.

A—0 to 8 inches; dark brown (10YR 3/3) loam, grayish brown (10YR 5/2) dry; strong fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine and few medium roots; many fine irregular pores; about 10 percent pebbles; strongly acid; clear wavy boundary.

Bs1—8 to 17 inches; dark yellowish brown (10YR 4/4) gravelly loam, light yellowish brown (10YR 6/4) dry; strong medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine and few medium and coarse roots; many very fine and fine irregular pores; about 25 percent pebbles; strongly acid; clear smooth boundary.

Bs2—17 to 24 inches; pale brown (10YR 6/3) gravelly sandy loam, very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; weakly smeary; common fine roots; many very fine irregular pores; about 15 percent pebbles; strongly acid; clear smooth boundary.

Bs3—24 to 35 inches; dark brown (7.5YR 4/4) gravelly loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine roots; many very fine and fine irregular and few fine tubular pores; about 20 percent pebbles; strongly acid; clear wavy boundary.

BC—35 to 45 inches; light brownish gray (2.5Y 6/2) gravelly loam, very pale brown (10YR 8/3) dry; moderate medium subangular blocky structure; very hard, friable, sticky and plastic; weakly smeary; few fine roots; many very fine and fine irregular and common very fine and fine tubular pores; about 30 percent pebbles; few thin clay films on faces of peds; strongly acid; clear irregular boundary.

2C—45 to 50 inches; light gray (2.5Y 7/2) gravelly loam, white (2.5Y 8/2) dry; massive; very hard, firm, sticky and plastic; about 15 percent pebbles; strongly acid; gradual smooth boundary.

2Cr—50 inches; weathered sandstone.

The thickness of the solum is 15 to 40 inches. The

depth to bedrock is 40 to 60 inches. The overall content of rock fragments in the control section ranges from 15 to 30 percent, although individual horizons may contain 35 to 40 percent pebbles.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6 when moist and 5 to 7 when dry, and chroma of 3 or 4 when moist and dry. It is gravelly loam or gravelly sandy loam.

The BC and C horizons have hue of 10YR or 2.5Y, value of 6 or 7 when moist and 7 or 8 when dry, and chroma of 2 to 4 when moist and dry. They are gravelly loam or gravelly sandy loam.

Cinebar Series

The Cinebar series consists of very deep, well drained soils formed in loess and slope alluvium high in content of volcanic ash. These soils are on back slopes and toe slopes in the foothills. Slopes are 6 to 65 percent. Elevation is 500 to 1,800 feet. The average annual precipitation is 50 to 75 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 165 to 185 days.

These soils are medial, mesic Typic Dystrandepts.

Typical pedon of Cinebar silt loam, 6 to 15 percent slopes, in Pierce County, southeast of Weyerhaeuser Road E. 810, about 1,400 feet south and 2,700 feet west of the northeast corner of sec. 20, T. 16 N., R. 5 E.

Oi—2 inches to 0; decomposed needles, twigs, leaves, and moss.

A—0 to 10 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; strong very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium and coarse roots; many very fine irregular pores; about 5 percent pebbles; moderately acid; clear smooth boundary.

AB—10 to 18 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; strong very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine, fine, and medium and few coarse roots; many very fine irregular pores; about 5 percent pebbles; moderately acid; clear smooth boundary.

Bw1—18 to 36 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky

structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium and coarse roots; many very fine tubular pores; about 5 percent pebbles; moderately acid; gradual smooth boundary.

Bw2—36 to 54 inches; yellowish brown (10YR 5/6) silt loam, brownish yellow (10YR 6/6) dry; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; common very fine tubular pores; about 10 percent pebbles; moderately acid; clear smooth boundary.

C—54 to 60 inches; yellowish brown (10YR 5/4) loam, very pale brown (10YR 7/4) dry; massive; hard, firm, slightly sticky and slightly plastic; weakly smeary; common very fine tubular pores; about 10 percent pebbles; moderately acid.

The thickness of the solum is more than 50 inches. The overall content of rock fragments in the control section ranges from 5 to 15 percent, although individual horizons may contain 15 to 25 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry. The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 5 when moist and 5 or 6 when dry, and chroma of 3 to 6 when moist and dry. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 when moist and 6 or 7 when dry, and chroma of 2 to 6 when moist and dry. It is loam or silt loam.

Cotteral Series

The Cotteral series consists of very deep, well drained soils formed in volcanic ash and cinders. These soils are on mountain back slopes. Slopes are 8 to 65 percent. Elevation is 2,800 to 4,900 feet. The average annual precipitation is 90 to 110 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 115 to 135 days.

These soils are cindery over medial Typic Cryorthods.

Typical pedon of Cotteral very cindery sandy loam, 8 to 30 percent slopes, in Pierce County, along Forest Service Road 159 about 1 mile west of Mt. Beljica, 1,500 feet south and 1,300 feet east of the northwest corner of sec. 20, T. 15 N., R. 7 E.

Oi—3 inches to 0; undecomposed twigs, moss, needles, and rotted wood.

E—0 to 2 inches; dark grayish brown (10YR 4/2) cindery sandy loam, pinkish gray (7.5YR 6/2) dry; weak medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine,

and medium and few coarse roots; many very fine irregular pores; about 30 percent pumice 2 to 5 millimeters in diameter; very strongly acid; abrupt wavy boundary.

Bs1—2 to 9 inches; reddish brown (5YR 4/4) very cindery sandy loam, strong brown (7.5YR 5/6) dry; weak medium granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine and few medium and coarse roots; many very fine irregular pores; about 40 percent pumice 2 to 5 millimeters in diameter; strongly acid; clear wavy boundary.

Bs2—9 to 19 inches; dark brown (7.5YR 4/4) very cindery sand, reddish yellow (7.5YR 6/6) dry; single grain; loose; common very fine and fine and few medium roots; many very fine irregular pores; about 50 percent pumice 2 to 5 millimeters in diameter; moderately acid; clear wavy boundary.

Bs3—19 to 32 inches; strong brown (7.5YR 5/8) very cindery sand, reddish yellow (7.5YR 7/8) dry; single grain; loose; few very fine and fine roots; many very fine irregular pores; about 50 percent pumice 2 to 5 millimeters in diameter; moderately acid; abrupt wavy boundary.

2Bs4—32 to 60 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; common very fine irregular and tubular pores; about 10 percent pebbles; moderately acid.

Depth to the 2B horizon is 14 to 36 inches. The content of pumice in the upper part of the control section ranges from 40 to 60 percent.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry.

The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 4 to 8 when moist and dry. It is very cindery sand or very cindery loamy sand.

The 2Bs horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 3 to 6 when moist and dry. It is silt loam, loam, or sandy loam.

Crinker Series

The Crinker series consists of well drained soils formed in a mixture of glacial till, volcanic ash, and colluvium and slope alluvium derived from phyllite. These soils are moderately deep to weathered bedrock. They are on mountain back slopes and shoulder slopes.

Slopes are 30 to 65 percent. Elevation is 2,600 to 3,600 feet. The average annual precipitation is 80 to 95 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 90 to 110 days.

These soils are loamy-skeletal, mixed Typic Cryorthods.

Typical pedon of Crinker very channery loam, 30 to 65 percent slopes, in King County, about 3 miles northeast of Skykomish, 2,000 feet north and 200 feet west of the southeast corner of sec. 21, T. 26 N., R. 12 E.

Oi—5 to 4 inches; undecomposed needles, leaves, and twigs.

Oa—4 inches to 0; decomposed organic mat.

E—0 to 2 inches; dark grayish brown (10YR 4/2) channery sandy loam, gray (10YR 6/1) and light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine irregular pores; about 15 percent channers and 5 percent pebbles; very strongly acid; abrupt smooth boundary.

Bhs—2 to 5 inches; dark brown (7.5YR 4/4) very channery loam, yellowish brown (10YR 5/4) dry; dark reddish brown (5YR 3/3) organic stains, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine irregular pores; about 40 percent channers and 20 percent pebbles; strongly acid; clear wavy boundary.

Bs—5 to 14 inches; dark yellowish brown (10YR 3/4) extremely channery loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine and common medium roots; many very fine irregular pores; about 40 percent channers and 30 percent pebbles; strongly acid; clear wavy boundary.

BC—14 to 22 inches; dark yellowish brown (10YR 4/4) extremely channery loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine roots; many very fine irregular pores; about 40 percent channers, 30 percent pebbles, and 5 percent cobbles; very strongly acid; clear wavy boundary.

2C—22 to 32 inches; dark grayish brown (2.5Y 4/2) extremely channery loam, light brownish gray (2.5Y 6/2) dry; massive; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine roots; many very fine irregular pores; about 70 percent

channers and 5 percent cobbles; very strongly acid; gradual wavy boundary.

2R—32 inches; weathered phyllite.

The depth to bedrock is 20 to 40 inches. The content of rock fragments in the control section ranges from 40 to 70 percent.

The E horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry.

The Bhs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is very channery or extremely channery loam.

The C horizon has hue of 2.5Y or 5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is extremely channery or very channery loam.

Cryofluvents

Cryofluvents consist of deep and very deep, well drained soils formed in alluvium over andesite. They are in mountain valleys. Slopes are 0 to 8 percent. Elevation is 2,800 to 3,500 feet. The average annual precipitation is 80 to 100 inches, and the mean annual air temperature is about 38 degrees F. The frost-free period is 90 to 110 days.

Typical pedon of Cryofluvents, 0 to 8 percent slopes, in Pierce County, about 2 miles north of Old Baldy Mountain on Forest Service Road 1819, about 1,200 feet east and 2,100 feet north of the southwest corner of sec. 14, T. 18 N., R. 7 E.

Oi—4 to 2 inches; undecomposed needles, leaves, and twigs.

Oa—2 inches to 0; decomposed needles, leaves, and twigs.

A—0 to 5 inches; dark brown (10YR 3/3) stony sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine roots; many very fine irregular pores; about 10 percent pebbles; very strongly acid; abrupt wavy boundary.

Bw—5 to 9 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and few medium roots; many fine irregular

pores; about 15 percent pebbles; very strongly acid; clear smooth boundary.

C1—9 to 21 inches; dark yellowish brown (10YR 4/6) gravelly loamy sand, light yellowish brown (10YR 6/4) dry; single grain; loose, nonsticky and nonplastic; common very fine and fine roots; many fine irregular pores; about 30 percent pebbles; strongly acid; clear smooth boundary.

C2—21 to 28 inches; dark brown (10YR 4/3) very gravelly loamy sand, pale brown (10YR 6/3) dry; single grain; loose, nonsticky and nonplastic; few fine roots; many fine irregular pores; about 35 percent pebbles and 10 percent cobbles; strongly acid; abrupt wavy boundary.

C3—28 to 49 inches; light olive brown (2.5Y 5/4) very gravelly fine sand, pale yellow (2.5Y 7/4) dry; single grain; loose, nonsticky and nonplastic; many fine irregular pores; about 45 percent pebbles and 10 percent cobbles; strongly acid; abrupt smooth boundary.

2R—49 inches; fractured andesite.

The depth to bedrock is 40 to 80 inches. The content of rock fragments in the particle-size control section ranges from 25 to 45 percent. The subsoil and substratum either are sandy or are sandy and are stratified with grayish, low-chroma, silty material.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist and dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is gravelly loamy sand, very gravelly sandy loam, or cobbly loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 3 to 6 when moist and dry. It is stratified sandy loam to extremely gravelly loamy sand.

Cryohemists

Cryohemists consist of very deep, very poorly drained soils formed in a mixture of peat, muck, pumice, volcanic ash, and glacial till. They are in depressions in mountain valleys and in cirques on mountains. Slopes are 0 to 2 percent. Elevation is 2,800 to 3,500 feet. The average annual precipitation is 90 to 120 inches, and the mean annual air temperature is about 41 degrees F. The frost-free period is 100 to 120 days.

Typical pedon of Cryohemists, 0 to 2 percent slopes, in Pierce County, about 6 miles northeast of Ashford, 1,100 feet west and 1,200 feet south of the northeast corner of sec. 25, T. 16 N., R. 6 E.

Oa—0 to 6 inches; black (10YR 2/1) muck, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many fine irregular pores; about 50 percent fiber before rubbing and 10 percent after rubbing; very strongly acid; clear smooth boundary.

Oe1—6 to 21 inches; very dark grayish brown (10YR 3/2) hemic material, dark grayish brown (10YR 4/2) dry; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many fine irregular pores; about 45 percent fiber before rubbing and 20 percent after rubbing; very strongly acid; clear wavy boundary.

Oe2—21 to 28 inches; dark brown (10YR 3/3) hemic material, reddish brown (5YR 4/3) dry; weak thin platy structure; slightly hard, friable, nonsticky and nonplastic; many fine irregular pores; about 45 percent fiber before rubbing and 20 percent after rubbing; slightly acid; abrupt smooth boundary.

2C—28 to 60 inches; gray (N 5/0) clay loam, light gray (N 6/0) dry; massive; hard, firm, slightly sticky and plastic; many fine irregular pores; slightly acid.

The organic material is 20 to more than 60 inches thick. The fiber in this material is derived mainly from grasses and sedges, but some pedons contain as much as 10 percent wood fragments. The content of fiber ranges from 40 to 70 percent before rubbing and from 20 to 40 percent after rubbing.

The Oa horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 2 to 4 when dry, and chroma of 1 to 3 when moist and dry. The Oe horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 2 to 4 when dry, and chroma of 2 or 3 when moist and dry. The 2C horizon, if it occurs, has hue of 2.5Y or is neutral in hue. It has value of 3 to 5 when moist and 5 to 7 when dry and chroma of 0 to 2 when moist and dry. It is clay loam or gravelly loam.

Dobbs Series

The Dobbs series consists of moderately well drained soils formed in volcanic ash, colluvium, and dense glacial till. These soils are moderately deep to dense glacial till. They are in cirque basins and on the adjacent mountain slopes. Slopes are 8 to 30 percent. Elevation is 2,000 to 3,200 feet. The average annual precipitation is 70 to 90 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 160 to 180 days.

These soils are medial-skeletal, frigid Andic Haplumbrepts.

Typical pedon of Dobbs loam, 8 to 30 percent slopes, in Pierce County, about 2 miles west of the junction of the Mowich and Puyallup Rivers, 2,400 feet north and 1,700 feet east of the southwest corner of sec. 5, T. 16 N., R. 6 E.

Oi—3 to 2 inches; undecomposed needles, leaves, and twigs.

Oa—2 inches to 0; well decomposed organic mat.

A—0 to 10 inches; dark brown (10YR 3/3) loam, dark brown (10YR 4/3) dry; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine, common medium, and few coarse roots; many very fine irregular pores; about 10 percent pebbles; slightly acid; abrupt wavy boundary.

Bw1—10 to 21 inches; dark brown (7.5YR 4/4) very gravelly loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium roots; many very fine irregular pores; about 25 percent pebbles and 10 percent cobbles; slightly acid; clear wavy boundary.

Bw2—21 to 28 inches; dark yellowish brown (10YR 4/4) very gravelly loam, yellowish brown (10YR 5/6) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; many very fine irregular pores; about 25 percent pebbles and 10 percent cobbles; slightly acid; clear wavy boundary.

Bw3—28 to 35 inches; yellowish brown (10YR 5/4) very gravelly loam, very pale brown (10YR 7/4) dry; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; many very fine irregular pores; about 35 percent pebbles and 10 percent cobbles; slightly acid; abrupt smooth boundary.

2Cd—35 to 60 inches; dark yellowish brown (10YR 4/4), dense glacial till that breaks to very gravelly sandy loam, very pale brown (10YR 7/4) dry; massive; hard, very firm, nonsticky and slightly plastic; about 45 percent pebbles and 10 percent cobbles; slightly acid.

The depth to dense glacial till is 30 to 40 inches. The content of rock fragments in the control section ranges from 35 to 50 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 3 or 4 when dry.

The Bw horizon has hue of 7.5YR or 10YR, value of

4 or 5 when moist and 5 to 7 when dry, and chroma of 4 to 6 when moist and dry. It is very gravelly loam or very gravelly silt loam.

Some pedons have a C horizon. The 2Cd horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 to 6 when moist and dry. It is dense glacial till that breaks to very gravelly loam or very gravelly sandy loam.

Edgewick Series

The Edgewick series consists of very deep, well drained soils formed in alluvium. These soils are on river terraces. Slopes are 0 to 3 percent. Elevation is 50 to 500 feet. The average annual precipitation is 50 to 70 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 140 to 160 days.

These soils are coarse-loamy, mixed, mesic Fluventic Haplumbrepts.

Typical pedon of Edgewick silt loam, 0 to 3 percent slopes, in King County, in the town of North Bend, 2,500 feet north and 1,000 feet east of the southwest corner of sec. 10, T. 23 N., R. 8 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; strongly acid; clear smooth boundary.

Bw1—8 to 10 inches; olive brown (2.5Y 4/4) silt loam, light gray (2.5Y 7/2) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; moderately acid; clear wavy boundary.

Bw2—10 to 20 inches; olive brown (2.5Y 4/4) silt loam, light gray (2.5Y 7/2) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; moderately acid; clear wavy boundary.

C1—20 to 33 inches; olive brown (2.5Y 4/4) fine sandy loam, pale yellow (2.5Y 7/4) dry; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; about 10 percent pebbles; moderately acid; gradual wavy boundary.

C2—33 to 46 inches; olive brown (2.5Y 4/4) loamy sand, light gray (2.5Y 7/2) dry; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; about 10 percent pebbles; moderately acid; clear wavy boundary.

2C3—46 to 60 inches; dark grayish brown (2.5Y 4/2) very gravelly sand, light brownish gray (2.5Y 6/2) dry; single grain; loose; many very fine irregular pores; about 50 percent pebbles; neutral.

Depth to the 2C horizon is 40 to more than 60 inches. The umbric epipedon is 7 to 10 inches thick.

The Ap horizon has hue of 10YR or 2.5Y and value of 2 or 3 when moist and 4 or 5 when dry. Reaction is very strongly acid to moderately acid.

The Bw horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is silt loam, loam, or fine sandy loam.

The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is fine sandy loam in the upper part and grades to loamy sand in the lower part.

The 2C horizon has hue of 2.5Y or 5Y, value of 2 to 4 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist and dry. Reaction is slightly acid or neutral.

Elwell Series

The Elwell series consists of moderately well drained soils formed in glacial till that has an admixture of volcanic ash and loess. These soils are moderately deep to ortstein. They are on glacially modified mountain back slopes and plateaus. Slopes are 6 to 65 percent. Elevation is 400 to 2,500 feet. The average annual precipitation is 60 to 80 inches, and the mean annual air temperature is about 45 degrees F. The frost-free period is 130 to 150 days.

These soils are coarse-loamy, mixed, frigid, ortstein Typic Haplorthods.

Typical pedon of Elwell silt loam, 6 to 30 percent slopes, in King County, about 2.5 miles northeast of Walsh Lake, 1,800 feet south and 2,600 feet east of the northwest corner of sec. 34, T. 23 N., R. 7 E.

Oa&Oi—3 inches to 0; fresh and decomposed needles, leaves, and twigs.

A—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium roots; many very fine irregular pores; about 10 percent pebbles; strongly acid; gradual smooth boundary.

Bs1—8 to 16 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly

plastic; weakly smeary; common very fine and fine and few medium roots; many very fine irregular pores; about 10 percent pebbles; strongly acid; abrupt smooth boundary.

Bs2—16 to 26 inches; dark brown (10YR 4/3) gravelly silt loam, pale brown (10YR 6/3) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium roots; many very fine irregular pores; about 15 percent pebbles; strongly acid; clear wavy boundary.

Bs3—26 to 35 inches; yellowish brown (10YR 5/4) gravelly silt loam, very pale brown (10YR 7/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; many very fine irregular pores; about 30 percent pebbles; strongly acid; clear wavy boundary.

Bsm—35 to 60 inches; grayish brown (2.5Y 5/2) ortstein that breaks to gravelly silt loam, light gray (2.5Y 7/2) dry; massive in place but parting to strong thick plates when removed; hard, firm, slightly sticky and slightly plastic; about 25 percent pebbles; strongly acid.

The depth to ortstein ranges from 20 to 40 inches.

The overall content of rock fragments in the control section ranges from 15 to 35 percent, although individual horizons may contain 35 to 45 percent pebbles.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist and dry. The Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 3 or 4 when moist and dry. It is silt loam, gravelly loam, or gravelly silt loam. The Bsm horizon has hue of 10YR or 2.5Y, value of 5 or 6 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is ortstein that breaks to gravelly silt loam, gravelly loam, gravelly sandy loam, or very gravelly sandy loam.

Ethania Series

The Ethania series consists of very deep, well drained soils formed in dacitic pumice and volcanic ash over residuum and colluvium derived from sandstone, andesite, or glacial till. These soils are on mountain ridge crests and back slopes and in cirque basins. Slopes are 8 to 90 percent. Elevation is 3,500 to 5,200 feet. The average annual precipitation is 80 to 110 inches, and the mean annual air temperature is about

37 degrees F. The frost-free period is 90 to 110 days.

These soils are cindery over medial-skeletal Typic Cryohumods.

Typical pedon of Ethania very cindery loamy sand, sandstone substratum, 30 to 65 percent slopes, in Pierce County, St. Regis Kapowsin Tree Farm, south of St. Regis Road 3210, about 1,950 feet east and 1,250 feet south of the northwest corner of sec. 26, T. 16 N., R. 6 E.

Oe—1 inch to 0; slightly decomposed needles, twigs and bark.

E—0 to 2 inches; brown (7.5YR 4/2) very cindery loamy sand, brown (7.5YR 5/2) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine, fine, medium, and coarse roots; about 35 percent by volume pumice 2 to 10 millimeters in diameter; very strongly acid; NaF pH less than 9.2; abrupt smooth boundary.

Bhs—2 to 3 inches; dark reddish brown (5YR 3/2) very cindery loamy sand, reddish brown (5YR 4/3) dry; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; weakly smeary; few very fine and fine roots; about 30 percent by volume pumice 2 to 10 millimeters in diameter; strongly acid; abrupt irregular boundary.

Bs1—3 to 6 inches; reddish brown (5YR 4/4) very cindery loamy sand, reddish yellow (5YR 6/6) dry; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; weakly smeary; few very fine and fine roots; about 40 percent by volume pumice 2 to 10 millimeters in diameter; moderately acid; NaF pH 11.5; abrupt irregular boundary.

Bs2—6 to 14 inches; strong brown (7.5YR 4/6) very cindery loamy sand, reddish yellow (7.5YR 7/6) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; few very fine roots; about 40 percent by volume pumice 2 to 10 millimeters in diameter; moderately acid; NaF pH 12.0+; abrupt irregular boundary.

2Eb—14 to 17 inches; grayish brown (10YR 5/2) loam, light gray (10YR 7/2) dry; weak fine subangular blocky structure; soft, friable, nonsticky and slightly plastic; moderately smeary; few very fine and fine roots; about 5 percent hard sandstone pebbles; strongly acid; NaF pH 9.6; abrupt smooth boundary.

2Bwb1—17 to 25 inches; dark yellowish brown (10YR 4/6) very gravelly loam, brownish yellow (10YR 6/6) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; moderately smeary; few very fine, fine, and coarse roots; about 35 percent hard sandstone

pebbles; strongly acid; NaF pH 11.0; abrupt smooth boundary.

2Bwb2—25 to 36 inches; dark yellowish brown (10YR 4/6) very gravelly sandy loam, brownish yellow (10YR 6/6) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; moderately smeary; few fine roots; about 30 percent hard sandstone pebbles and 15 percent soft sandstone cobbles; moderately acid; NaF pH 11.0; abrupt smooth boundary.

2BCb—36 to 60 inches; olive brown (2.5Y 4/4) extremely cobbly loamy sand, pale yellow (2.5Y 7/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; about 20 percent hard sandstone pebbles and 50 percent sandstone cobbles; moderately acid; NaF pH 11.0.

The upper 4 to 14 inches of the particle-size control section has 35 to 50 percent volcanic pumice and cinders 2 to 10 millimeters in diameter and 25 to 40 percent volcanic ash. The lower part has less than 10 percent volcanic ash and pumice and 40 to 70 percent sandstone or andesite pebbles and cobbles by volume.

The E horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist and dry. Reaction is very strongly acid to moderately acid.

The Bhs horizon has value of 3 or 4 when moist and 4 or 5 when dry and chroma of 2 to 4 when moist and dry. Reaction is very strongly acid to moderately acid.

The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6 when moist and 5 to 8 when dry, and chroma of 4 to 8 when moist and dry. Reaction is strongly acid or moderately acid.

The 2Eb horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 6 to 8 when dry, and chroma of 1 or 2 when moist and dry. It is loam or sandy loam in the fine-earth fraction. It has 5 to 20 percent coarse fragments by volume. Reaction is strongly acid or moderately acid.

The 2Bwb horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 4 to 6 when moist and dry. It is loam or sandy loam in the fine-earth fraction. It has 35 to 60 percent coarse fragments by volume. Reaction is strongly acid or moderately acid.

The 2BCb horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 4 to 6 when moist and dry. It is sandy loam or loamy sand in the fine-earth fraction. It has 50 to 70 percent coarse fragments by volume. Reaction is strongly acid or moderately acid.

Foss Series

The Foss series consists of very deep, well drained soils formed in volcanic ash and pumice over residuum and colluvium derived from andesite. These soils are on the interior side slopes and back slopes of cirque basins, on broad ridge crests, and on benches. Slopes are 8 to 65 percent. Elevation is 3,000 to 5,000 feet. The average annual precipitation is 70 to 110 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 110 to 130 days.

These soils are medial over loamy-skeletal, mixed Typic Cryorthods.

Typical pedon of Foss stony sandy loam, 8 to 30 percent slopes, in Pierce County, about 2 miles east of the junction of Lighting Creek and the White River, 400 feet west and 1,600 feet north of the southeast corner of sec. 32, T. 19 N., R. 10 E.

A—0 to 4 inches; very dark brown (10YR 2/2) stony sandy loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; about 10 percent pebbles and 5 percent stones; strongly acid; abrupt smooth boundary.

Bs1—4 to 10 inches; yellowish brown (10YR 5/4) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; single grain; loose, nonsticky and nonplastic; weakly smeary; many very fine, fine, medium, and coarse roots; about 15 percent pebbles; moderately acid; gradual smooth boundary.

Bs2—10 to 16 inches; strong brown (7.5YR 4/6) gravelly sandy loam, brown (7.5YR 5/4) dry; single grain; loose, nonsticky and nonplastic; weakly smeary; common very fine, fine, and medium roots; about 30 percent pebbles; moderately acid; gradual irregular boundary.

2Bs3—16 to 32 inches; dark brown (7.5YR 3/4) very cobbly silt loam, reddish brown (5YR 4/4) dry; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; moderately smeary; common fine and medium roots; few thin silt coatings on faces of peds and in pores; about 35 percent cobbles and 15 percent pebbles; strongly acid; clear wavy boundary.

2BC1—32 to 48 inches; dark reddish brown (5YR 3/3) very gravelly silt loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; moderately smeary; few fine and medium roots; common thin silt coatings on faces of peds and in

pores; about 45 percent pebbles and 5 percent cobbles; moderately acid; abrupt smooth boundary.
 2BC2—48 to 60 inches; dark reddish brown (5YR 3/4) very gravelly silt loam, reddish brown (5YR 4/4) dry; strong thin and medium platy structure; very hard, very firm, slightly sticky and slightly plastic; moderately smeary; common thin to thick silt coatings on faces of peds and in pores; about 50 percent pebbles and 5 percent cobbles; moderately acid.

The control section is loam or silt loam. It has 35 to 55 percent rock fragments, including 5 to 40 percent cobbles. Reaction is strongly acid or moderately acid throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry. It has 2 to 10 percent stones.

The Bs horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6 when moist and dry. It is sandy loam or loam in the fine-earth fraction. It has 15 to 35 percent gravel.

The 2Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist and dry. It is loam or silt loam in the fine-earth fraction. It has 35 to 60 percent coarse fragments.

The 2BC horizon is loam or silt loam in the fine-earth fraction. It has 40 to 60 percent coarse fragments.

Gallup Series

The Gallup series consists of very deep, well drained soils formed in volcanic ash and colluvium derived from breccia. These soils are on glacially modified mountain ridgetops and back slopes. Slopes are 15 to 65 percent. Elevation is 2,700 to 3,600 feet. The average annual precipitation is 80 to 100 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 95 to 120 days.

These soils are coarse-loamy, mixed Humic Cryorthods.

Typical pedon of Gallup loam, breccia substratum, 30 to 65 percent slopes, in King County, about 3 miles southwest of North Bend, 1,800 feet north and 700 feet east of the southwest corner of sec. 20, T. 23 N., R. 8 E.

Oa—2 inches to 0; undecomposed needles and twigs.

A—0 to 4 inches; dark reddish brown (5YR 3/2) loam, brown (7.5YR 5/4) dry; moderate fine granular structure; slightly hard, friable, nonsticky and slightly plastic; weakly smeary; many very fine, fine, and medium roots; many very fine irregular pores; about

5 percent pebbles; very strongly acid; abrupt smooth boundary.

E—4 to 7 inches; dark reddish gray (5YR 4/2) loam, pinkish gray (5YR 6/2) dry; moderate very fine subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; weakly smeary; common very fine, fine, and medium roots; many very fine irregular pores; about 5 percent pebbles; extremely acid; abrupt wavy boundary.

Bhs—7 to 15 inches; dark reddish brown (5YR 3/4) loam, reddish brown (5YR 5/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium roots; many very fine irregular pores; about 5 percent pebbles; extremely acid; clear wavy boundary.

Bs1—15 to 23 inches; dark brown (7.5YR 4/4) loam, brown (7.5YR 5/4) dry; moderate very fine and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; many very fine irregular pores; about 10 percent pebbles; extremely acid; gradual wavy boundary.

Bs2—23 to 36 inches; dark yellowish brown (10YR 4/4) gravelly loam, light yellowish brown (10YR 6/4) dry; weak very fine and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; many very fine irregular pores; about 20 percent pebbles and 5 percent cobbles; very strongly acid; gradual wavy boundary.

Bs3—36 to 49 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; many very fine irregular pores; about 25 percent pebbles and 5 percent cobbles; very strongly acid; clear smooth boundary.

C—49 to 60 inches; dark yellowish brown (10YR 4/6) gravelly loam, very pale brown (10YR 7/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine irregular pores; about 15 percent pebbles and 5 percent cobbles; extremely acid.

The content of rock fragments in the control section ranges from 15 to 35 percent.

The A horizon has hue of 5YR or 7.5YR, value of 4 or 5 when dry, and chroma of 2 to 4 when moist and dry. Some pedons do not have an A horizon.

The E horizon has hue of 5YR or 7.5YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1

or 2 when moist and dry. It is loam or silt loam.

The Bhs and Bs1 horizons have hue of 5YR or 7.5YR, value of 3 or 4 when moist, and chroma of 3 or 4 when moist and 3 to 6 when dry. They are loam, silt loam, gravelly loam, or gravelly silt loam.

The Bs2 and Bs3 horizons have hue of 7.5YR or 10YR, value of 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. They are gravelly loam, gravelly silt loam, or gravelly sandy loam.

The C horizon has value of 6 or 7 when dry and chroma of 4 to 6 when moist and dry. It is gravelly loam, gravelly sandy loam, very gravelly loam, or very gravelly sandy loam.

Getchell Series

The Getchell series consists of moderately well drained soils formed in volcanic ash, colluvium, and dense glacial till. These soils are moderately deep to ortstein. They are on mountain back slopes and plateaus. Slopes are 6 to 65 percent. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 80 to 95 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 95 to 115 days.

These soils are coarse-loamy, mixed, ortstein Typic Cryorthods.

Typical pedon of Getchell loam, 15 to 30 percent slopes, in King County, about 1 mile southwest of Lake Hancock, 2,200 feet west and 1,100 feet north of the southeast corner of sec. 17, T. 24 N., R. 9 E.

Oi—3 to 2 inches; undecomposed needles and twigs.

Oa—2 inches to 0; decomposed organic mat.

E—0 to 3 inches; dark gray (10YR 4/1) loamy sand, gray (10YR 6/1) dry; single grain; loose, nonsticky and nonplastic; weakly smeary; common very fine, fine, and medium and few coarse roots; many very fine irregular pores; about 5 percent pebbles; extremely acid; abrupt wavy boundary.

Bhs—3 to 7 inches; black (5YR 2/1) silt loam, dark reddish brown (5YR 3/2) dry; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium roots; many very fine irregular pores; about 5 percent pebbles; very strongly acid; abrupt wavy boundary.

Bs1—7 to 12 inches; dark reddish brown (5YR 3/4) loam, reddish brown (5YR 4/4) dry; moderate fine and medium angular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; weakly smeary; common very fine and few fine roots; about 10 percent pebbles; very strongly acid; clear wavy boundary.

Bs2—12 to 19 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; many very fine irregular pores; about 5 percent pebbles; very strongly acid; abrupt wavy boundary.

Bs3—19 to 30 inches; light yellowish brown (10YR 6/4) gravelly loam, very pale brown (10YR 7/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; many very fine irregular pores; about 15 percent pebbles; very strongly acid; clear wavy boundary.

2Bsm—30 to 60 inches; light olive brown (2.5Y 5/4) ortstein that breaks to loam, pale yellow (2.5Y 7/4) dry; massive; hard, firm, slightly sticky and slightly plastic; weakly smeary; about 5 percent pebbles; very strongly acid.

The depth to ortstein ranges from 20 to 40 inches. The content of rock fragments in the control section ranges from 0 to 10 percent.

The E horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry.

The Bhs horizon has hue of 5YR or 7.5YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 1 or 2 when moist and dry. It is silt loam or loam.

The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 6 when moist and 4 to 7 when dry, and chroma of 4 to 6 when moist and dry. It is loam or gravelly loam.

The 2Bsm horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is ortstein that breaks to silt loam, loam, or gravelly loam.

Greenwater Series

The Greenwater series consists of very deep, somewhat excessively drained soils formed in alluvium derived from andesite and pumice. These soils are on terraces. Slopes are 0 to 8 percent. Elevation is 500 to 1,800 feet. The average annual precipitation is 50 to 70 inches, and the mean annual air temperature is about 49 degrees F. The frost-free period is 140 to 160 days.

These soils are mixed, mesic Dystric Xeropsamments.

Typical pedon of Greenwater loamy sand, 0 to 8 percent slopes, in Pierce County, about 3 miles west of the Nisqually Park Ranger Station, 1,800 feet south and 200 feet east of the northwest corner of sec. 31, T. 15 N., R. 7 E.

- Oi—3 inches to 0.5 inch; undecomposed twigs, leaves, and moss.
- Oa—0.5 inch to 0; decomposed organic mat.
- A—0 to 5 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many fine irregular pores; about 10 percent pumice 2 to 5 millimeters in diameter; strongly acid; clear smooth boundary.
- Bs—5 to 17 inches; dark brown (7.5YR 3/4) loamy sand, brown (7.5YR 5/4) dry; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many fine irregular pores; about 10 percent pumice 2 to 5 millimeters in diameter; moderately acid; abrupt smooth boundary.
- C1—17 to 25 inches; dark grayish brown (10YR 4/2) sand, light brownish gray (10YR 6/2) dry; massive; slightly hard, firm, nonsticky and nonplastic; few very fine roots; common fine irregular pores; about 10 percent pumice 2 to 5 millimeters in diameter; moderately acid; clear smooth boundary.
- C2—25 to 51 inches; dark gray (10YR 4/1) coarse sand, gray (10YR 6/1) dry; single grain; loose; many fine irregular pores; about 5 percent pumice 2 to 5 millimeters in diameter and 5 percent pebbles; slightly acid; clear smooth boundary.
- 2C3—51 to 60 inches; dark gray (10YR 4/1) very gravelly coarse sand, gray (10YR 6/1) dry; single grain; loose; many fine irregular pores; about 55 percent pebbles and 5 percent pumice 2 to 5 millimeters in diameter; slightly acid.

The thickness of the solum is 14 to 24 inches. In the control section, the content of rock fragments ranges from 0 to 10 percent and the content of pumice ranges from 5 to 15 percent.

The A horizon has value of 2 or 3 when moist and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist and dry. It is loamy sand or sand.

The C horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist and dry. It is sand or coarse sand.

The 2C horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist and dry. It is very gravelly sand or very gravelly coarse sand.

Grotto Series

The Grotto series consists of very deep, somewhat excessively drained soils formed in alluvium. These

soils are on river terraces. Slopes are 0 to 8 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 60 to 100 inches, and the average annual air temperature is about 45 degrees F. The frost-free period is 135 to 155 days.

These soils are sandy-skeletal, mixed, frigid Typic Haplorthods.

Typical pedon of Grotto gravelly loamy sand, 0 to 8 percent slopes, in King County, about 0.5 mile south of Greenwater, 2,400 feet south and 1,300 feet west of the northeast corner of sec. 10, T. 19 N., R. 9 E.

- Oi—2 inches to 1 inch; forest litter, including undecomposed needles, bark, and twigs.
- Oe—1 inch to 0; decomposed needles, twigs, and bark.
- E—0 to 5 inches; brown (7.5YR 5/2) gravelly loamy sand, pinkish gray (7.5YR 7/2) dry; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many fine and common medium and coarse roots; many fine irregular pores; about 30 percent pebbles; moderately acid; clear smooth boundary.
- Bhs—5 to 19 inches; dark brown (7.5YR 3/2) very gravelly coarse sand, brown (10YR 4/3) dry; weak fine subangular blocky structure; common fine, medium, and coarse roots; many fine irregular pores; about 40 percent pebbles; moderately acid; clear wavy boundary.
- Bs—19 to 36 inches; brown (10YR 4/3) and strong brown (7.5YR 5/6) very gravelly coarse sand, pale brown (10YR 6/3) and reddish yellow (7.5YR 7/6) dry; massive; hard when in place and slightly hard or soft when removed, firm when in place and friable when removed, nonsticky and nonplastic; common medium roots; many fine irregular pores; about 45 percent pebbles; slightly acid; clear smooth boundary.
- C—36 to 60 inches; yellowish brown (10YR 5/4 and 5/6) very gravelly sand, light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6) dry; massive; hard when in place and slightly hard when removed, firm when in place and friable when removed, nonsticky and nonplastic; few medium roots; about 55 percent pebbles; slightly acid.

The particle-size control section ranges from 35 to 55 percent coarse fragments by volume.

The E horizon has hue of 7.5YR or 10YR, value of 2 to 5 when moist and 4 to 7 when dry, and chroma of 2 to 4 when moist and dry. The upper 3 inches has value and chroma of 2 or 3 when moist. The content of coarse fragments is 20 to 50 percent by volume. Reaction is strongly acid or very strongly acid.

The Bs horizon has hue of 7.5YR or 10YR, value of

3 to 5 when moist, and chroma of 3 to 6 when moist and dry. It is very gravelly loamy sand, very gravelly sand, or very gravelly coarse sand. It has 35 to 60 percent coarse fragments. Reaction is moderately acid or slightly acid.

The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 to 5 when moist and 4 to 7 when dry, and chroma of 2 to 6 when moist and dry. It is very gravelly sand or very gravelly coarse sand. It has 35 to 60 percent coarse fragments. Reaction is moderately acid or slightly acid.

Hartnit Series

The Hartnit series consists of well drained soils formed in glacial till, volcanic ash, and colluvium weathered from andesite. These soils are moderately deep to bedrock. They are on glacially modified mountain ridgetops and back slopes. Slopes are 8 to 30 percent. Elevation is 2,600 to 3,600 feet. The average annual precipitation is 80 to 100 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 90 to 100 days.

These soils are coarse-loamy, mixed Typic Cryorthods.

Typical pedon of Hartnit silt loam, 8 to 30 percent slopes, in King County, about 1 mile east of Kernston, 200 feet west and 400 feet south of the northeast corner of sec. 30, T. 23 N., R. 8 E.

Oa—7 inches to 0; decomposed needles, leaves, and twigs.

A—0 to 3 inches; dark brown (7.5YR 4/4) silt loam, brown (7.5YR 5/4) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; common very fine and fine roots; many very fine irregular pores; about 10 percent pebbles; strongly acid; abrupt smooth boundary.

Bhs—3 to 11 inches; strong brown (7.5YR 4/6) gravelly silt loam, strong brown (7.5YR 5/6) dry; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; common very fine and few fine roots; many very fine irregular pores; about 20 percent pebbles; strongly acid; clear smooth boundary.

Bs—11 to 20 inches; dark yellowish brown (10YR 4/4) gravelly silt loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; common very fine roots; many very fine irregular pores; about 25 percent pebbles; strongly acid; abrupt smooth boundary.

C—20 to 31 inches; dark yellowish brown (10YR 4/4)

very gravelly silt loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; few very fine roots; many very fine irregular pores; about 40 percent pebbles; strongly acid; abrupt smooth boundary. 2R—31 inches; andesite.

The depth to bedrock is 20 to 40 inches. The overall content of rock fragments in the particle-size control section ranges from 15 to 35 percent by weighted average, although individual horizons contain as much as 50 percent.

The A horizon has hue of 5YR or 7.5YR, value of 3 or 4 when moist, and chroma of 3 or 4 when moist and dry. Some pedons have an E horizon.

The Bhs and Bs horizons have hue of 7.5YR or 10YR, value of 3 to 5 when moist and 4 or 5 when dry, and chroma of 3 to 6 when moist and dry. They are silt loam, loam, gravelly silt loam, or gravelly loam.

The C horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 5 to 7 when dry, and chroma of 3 or 4 when moist and dry. It is gravelly silt loam, gravelly loam, very gravelly silt loam, or very gravelly loam.

Haywire Series

The Haywire series consists of well drained soils formed in volcanic ash and pumice over residuum and colluvium derived from extrusive igneous rocks or from tuff and breccia. These soils are moderately deep to bedrock. They are on ridgetops and mountain back slopes. Slopes are 8 to 65 percent. Elevation is 3,400 to 6,000 feet. The average annual precipitation is 80 to 120 inches, and the mean annual air temperature is about 40 degrees F. The frost-free period is 90 to 110 days.

These soils are loamy-skeletal, mixed Typic Cryohumods.

Typical pedon of Haywire sandy loam, 30 to 65 percent slopes, in King County, on Grass Mountain, 2,250 feet east and 1,900 feet north of the southwest corner of sec. 21, T. 20 N., R. 8 E.

Oi—1 to 0.5 inch; loose forest litter, including needles and twigs; abrupt smooth boundary.

Oa—0.5 inch to 0; decomposed organic litter; common fine, medium, and coarse roots; abrupt smooth boundary.

E—0 to 1 inch; very dark gray (10YR 3/1) loamy sand (volcanic ash and pumice), gray (10YR 5/1) dry; single grain; loose; weakly smeary; many very fine, fine, and medium roots; very strongly acid; abrupt smooth boundary.

Bhs—1 to 4 inches; dusky red (2.5YR 3/2) loam (volcanic ash and pumice), dark reddish brown (5YR 3/4) dry; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; moderately smeary; many very fine, fine, and medium and common coarse roots; about 5 percent pebbles; very strongly acid; clear irregular boundary.

Bs1—4 to 9 inches; dark reddish brown (5YR 3/4) loam (volcanic ash and pumice), dark brown (7.5YR 3/4) dry; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; moderately smeary; many very fine, fine, and medium and common coarse roots; about 10 percent pebbles; very strongly acid; clear irregular boundary.

Bs2—9 to 17 inches; dark reddish brown (5YR 3/4) gravelly loam, dark brown (7.5YR 4/4) dry; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; moderately smeary; common very fine and many fine and medium roots; about 25 percent gravel and 5 percent cobbles; strongly acid; clear irregular boundary.

Bs3—17 to 25 inches; dark brown (7.5YR 3/4) very cobbly loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; moderately smeary; common fine and medium roots; about 25 percent gravel, 10 percent cobbles, and 5 percent stones; strongly acid; clear smooth boundary.

BC1—25 to 28 inches; dark yellowish brown (10YR 4/4) extremely cobbly loam, light yellowish brown (10YR 6/4) dry; massive; soft, friable, slightly sticky and slightly plastic; about 35 percent gravel, 20 percent cobbles, and 10 percent stones; strongly acid; clear smooth boundary.

BC2—28 to 36 inches; dark yellowish brown (10YR 4/4) extremely cobbly loam, light yellowish brown (10YR 6/4) dry; massive; soft, friable, slightly sticky and slightly plastic; about 50 percent gravel, 20 percent cobbles, and 10 percent stones; moderately acid; abrupt smooth boundary.

2R—36 inches; fractured andesite.

The depth to lithic contact is 20 to 40 inches. The control section is sandy loam, loam, or silt loam in the fine-earth fraction. It has 35 to 80 percent rock fragments.

The E horizon has hue of 10YR or 7.5YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 1 or 2 when moist and dry. It has 0 to 10 percent hard cinders and pebbles. In some pedons it is weakly expressed or does not occur.

The Bhs horizon has hue of 2.5YR, 5YR, 7.5YR, or

10YR, value of 3 or 4 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist and dry. It is sandy loam, loam, loamy sand, gravelly sandy loam, or gravelly loam. It has 5 to 30 percent pebbles and hard cinders. Reaction is very strongly acid or strongly acid.

The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 or 4 when moist and 3 to 6 when dry, and chroma of 3 to 6 when moist and dry. The upper part of this horizon is loam, gravelly sandy loam, very gravelly sandy loam, very gravelly loam, gravelly loam, or very cobbly loam. It has 10 to 40 percent pebbles and 0 to 10 percent cobbles. The lower part is very cobbly loam, extremely gravelly loam, extremely gravelly sandy loam, gravelly loam, or very gravelly loam. It has 25 to 50 percent pebbles, 5 to 15 percent cobbles, and 0 to 5 percent stones.

The BC horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 4 to 6 when moist and dry. It is very gravelly loam, very gravelly silt loam, or extremely cobbly loam. It ranges from 30 to 60 percent pebbles, 10 to 20 percent cobbles, and 0 to 10 percent stones. Reaction is strongly acid or moderately acid.

Hinker Series

The Hinker series consists of well drained soils formed in volcanic ash and in colluvium and slope alluvium derived from phyllite. These soils are moderately deep to bedrock. They are on glacially modified mountain shoulder slopes. Slopes are 8 to 90 percent. Elevation is 3,500 to 4,200 feet. The average annual precipitation is 85 to 100 inches, and the mean annual air temperature is about 41 degrees F. The frost-free period is 85 to 100 days.

These soils are loamy-skeletal, mixed Humic Cryorthods.

Typical pedon of Hinker gravelly sandy loam, 30 to 65 percent slopes, in King County, about 4 miles southeast of Skykomish, 2,000 feet west and 1,800 feet south of the northeast corner of sec. 4, T. 25 N., R. 12 E.

Oi—2 inches to 0; undecomposed needles, leaves, and twigs.

E—0 to 3 inches; brown (7.5YR 5/2) gravelly loamy sand, pinkish gray (7.5YR 7/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; many very fine, common fine, and few medium roots; many very fine irregular pores; about 15 percent pebbles; NaF pH 9.4; very strongly acid; abrupt smooth boundary.

Bhs1—3 to 8 inches; dark reddish brown (5YR 3/4) gravelly silt loam, dark brown (7.5YR 4/4) and

strong brown (7.5YR 5/6) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; common very fine, fine, medium, and coarse roots; many very fine irregular pores; about 10 percent pebbles, 10 percent channers, and 5 percent cobbles; NaF pH 11.0; very strongly acid; clear wavy boundary.

Bhs2—8 to 17 inches; dark brown (7.5YR 3/4) and strong brown (7.5YR 4/6) very channery loam, yellowish brown (10YR 5/6) dry; moderate fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and few fine roots; many very fine irregular pores; about 25 percent channers and 20 percent pebbles; NaF pH 12.0; very strongly acid; clear wavy boundary.

2BC—17 to 22 inches; dark grayish brown (2.5Y 4/2) very channery loam, light yellowish brown (2.5Y 6/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; few very fine roots; many very fine irregular pores; about 45 percent channers and 10 percent pebbles; NaF pH 11.5; strongly acid; clear smooth boundary.

2C—22 to 38 inches; dark grayish brown (2.5Y 4/2) extremely channery loam, light brownish gray (2.5Y 6/2) dry; massive; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine irregular pores; about 65 percent channers and 5 percent cobbles; NaF pH 11.0; strongly acid; clear smooth boundary.

2R—38 inches; highly fractured phyllite.

The depth to bedrock is 20 to 40 inches. The particle-size control section has 35 to 60 percent phyllite channers and pebbles and 10 to 25 percent flagstones.

The E horizon has hue of 5YR, 7.5YR, or 10YR and value of 4 to 6 when moist and 5 to 7 when dry.

The Bhs horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 4 to 6 when moist and dry. It is channery or gravelly loam, channery or gravelly silt loam, very channery loam, or very channery silt loam.

The 2BC and 2C horizons have hue of 2.5Y or 5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry. They are very channery loam, extremely channery loam, or extremely channery silt loam.

Humaquepts

Humaquepts consist of very deep, poorly drained soils formed in alluvium. They are on terraces. Slopes

are 0 to 5 percent. Elevation is 1,800 to 2,800 feet. The average annual precipitation is 70 to 90 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 130 to 150 days.

Typical pedon of Humaquepts, 0 to 5 percent slopes, in Pierce County, about 2.5 miles southeast of Ohop, 2,300 feet east and 1,800 feet south of the northwest corner of sec. 34, T. 17 N., R. 5 E.

Oi—1 inch to 0; well decomposed organic material.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine, common medium, and few coarse roots; many very fine irregular pores; about 10 percent pebbles; very strongly acid; clear smooth boundary.

A2—5 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine irregular pores; about 10 percent pebbles; very strongly acid; clear smooth boundary.

Bg—13 to 25 inches; grayish brown (10YR 5/2) gravelly silty clay loam, light gray (10YR 7/2) dry; common medium prominent mottles, yellowish red (5YR 5/8) moist and dry; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many very fine and fine tubular pores; about 15 percent pebbles; few thin clay films on faces of peds; strongly acid; clear smooth boundary.

Cg—25 to 60 inches; grayish brown (10YR 5/2) very gravelly loam, light gray (10YR 7/2) dry; massive; hard, firm, slightly sticky and slightly plastic; about 40 percent pebbles and 15 percent cobbles; strongly acid.

The content of clay in the particle-size control section ranges from 5 to 35 percent. The thickness of the solum is 15 to 40 inches. The content of rock fragments in the particle-size control section ranges from 15 to 50 percent. The distribution of organic carbon varies with increasing depth.

The A horizon has value of 2 or 3 when moist and 4 to 6 when dry. The Bg horizon has hue of 10YR or 2.5Y and value of 4 or 5 when moist and 6 or 7 when dry. It is loam, gravelly sandy loam, or gravelly silty clay loam. The Cg horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry. It is silty clay loam, gravelly sand, or very gravelly loam.

Humods

Humods consist of moderately deep to very deep, well drained soils formed in colluvium derived from granite. They are in areas of avalanche on back slopes in the mountains. Slopes are 30 to 100 percent. Elevation is 1,500 to 5,000 feet. The average annual precipitation is 90 to 120 inches, and the mean annual air temperature is about 39 degrees F. The frost-free period is 110 to 130 days.

Typical pedon of Humods, in an area of Orthents, avalanche chutes-Humods complex, 30 to 100 percent slopes, in King County, about 1 mile east of the Skykomish Ranger Station; 2,500 feet east and 1,100 feet south of the northwest corner of sec. 30, T. 26 N., R. 13 E.

A—0 to 5 inches; black (10YR 2/1) very gravelly sandy loam, dark brown (7.5YR 4/2) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; about 5 percent stones, 5 percent cobbles, and 35 percent pebbles; strongly acid; abrupt wavy boundary.

Bhs—5 to 14 inches; dark brown (7.5YR 4/4) extremely stony sandy loam, light yellowish brown (10YR 6/4) dry; dark reddish brown (5YR 3/2) organic stains, brown (7.5YR 5/2) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine irregular pores; about 40 percent stones, 20 percent cobbles, and 25 percent pebbles; very strongly acid; clear wavy boundary.

Bs—14 to 26 inches; dark yellowish brown (10YR 3/4) extremely stony sandy loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium and coarse roots; many very fine irregular pores; about 50 percent stones, 20 percent cobbles, and 20 percent pebbles; strongly acid; abrupt wavy boundary.

2R—26 inches; weathered granite.

The depth to bedrock is 20 to 80 inches. The content of rock fragments in the control section ranges from 50 to 90 percent.

The A horizon has hue of 5YR, 7.5YR, or 10YR, value of 2 to 5 when moist and 4 to 7 when dry, and chroma of 1 or 2 when moist and dry.

The Bhs horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is very gravelly

sandy loam, very cobbly loamy sand, or extremely stony sandy loam.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is extremely stony sandy loam or very gravelly loamy sand.

Index Series

The Index series consists of deep and very deep, well drained soils formed in volcanic ash and pumice mixed with colluvium derived from granitic and metamorphic rocks. These soils are on mountain back slopes. Slopes are 8 to 90 percent. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 75 to 110 inches, and the mean annual air temperature is about 42 degrees F. The average frost-free period is 110 to 130 days.

These soils are sandy-skeletal, mixed Haplic Cryohumods.

Typical pedon of Index loamy sand, 65 to 90 percent slopes, in King County, on the east side of the Hansen Creek drainage, about 100 feet east of Forest Service Road 2291.1, about 2,300 feet south and 1,800 feet west of the northeast corner of sec. 22, T. 22 N., R. 10 E.

Oi—3 to 2 inches; loose forest litter, including needles, twigs, bark, and moss.

Oa—2 inches to 0; black (10YR 2/1), highly decomposed organic material that is bound by roots; abrupt smooth boundary.

E—0 to 2 inches; gray (10YR 5/1) loamy sand (volcanic ash and pumice), light gray (N 7/0) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine roots; very strongly acid; abrupt wavy boundary.

Bhs—2 to 4 inches; dark reddish brown (5YR 3/3) sandy loam (volcanic ash and pumice), dark brown (7.5YR 4/4) dry; weak fine subangular blocky structure; slightly hard, firm, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium and coarse roots; moderately acid; abrupt wavy boundary.

Bs1—4 to 7 inches; variegated reddish brown (5YR 4/4) and light gray (2.5Y 7/2) loamy sand (volcanic ash and pumice), variegated yellowish red (5YR 5/6) and white (2.5Y 8/2) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; many very fine and fine and few medium and coarse roots; moderately acid; abrupt irregular boundary.

Bs2—7 to 15 inches; dark brown (7.5YR 4/4) very

cobbly loamy sand, brown (7.5YR 5/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine and few medium and coarse roots; about 15 percent pebbles and 25 percent cobbles; strongly acid; clear smooth boundary.

2BC—15 to 23 inches; dark yellowish brown (10YR 4/4) very gravelly loamy sand, strong brown (7.5YR 5/6) dry; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine and few moderate and coarse roots; about 30 percent pebbles and 20 percent cobbles; moderately acid; clear smooth boundary.

2C1—23 to 40 inches; light yellowish brown (10YR 6/4) extremely cobbly sand, very pale brown (10YR 7/4) dry; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; about 25 percent pebbles and 40 percent cobbles; strongly acid; gradual smooth boundary.

2C2—40 to 57 inches; pale yellow (2.5Y 7/4) extremely cobbly sand, light yellowish brown (10YR 6/4) dry; massive; slightly hard, very friable, nonsticky and nonplastic; about 35 percent pebbles and 30 percent cobbles; strongly acid; clear smooth boundary.

2Cr—57 inches; yellowish brown (10YR 5/6), highly weathered granodiorite, very pale brown (10YR 8/4) dry; can be cut by a spade with difficulty and breaks to very gravelly coarse sand; about 60 percent hard pebbles; slightly acid.

The depth to paralithic contact is 40 to 70 inches. The content of rock fragments, including hard cinders, in the particle-size control section ranges from 35 to 70 percent by volume.

The E horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 5 to 7 when moist and 6 or 7 when dry and chroma of 0 to 2 when moist and dry. Reaction is moderately acid to very strongly acid.

The Bhs horizon has value of 3 to 5 when moist and 4 or 5 when dry and chroma of 3 to 6 when moist and dry. Reaction is moderately acid to very strongly acid.

The Bs horizon has hue of 2.5Y to 5YR. Where it has hue of 10YR to 5YR, it has value of 3 or 4 when moist and 4 or 5 when dry and chroma of 4 to 6 when moist and dry. Where it has hue of 2.5Y, it has value of 6 to 8 when moist and 7 or 8 when dry and chroma of 2 or 3 when moist and dry. This horizon is sand or loamy sand in the fine-earth fraction. It has 30 to 60 percent rock fragments in the lower part. The fine-earth fraction is more than 60 percent volcanic ash and pumice. Reaction is moderately acid or strongly acid.

The 2BC horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6 when moist and dry. The

fine-earth fraction is loamy sand or sand. This horizon has 40 to 60 percent rock fragments by volume. Reaction is moderately acid or strongly acid.

The 2C horizon has hue of 10YR or 2.5YR and value of 6 or 7 when moist and dry. It has 50 to 70 percent coarse fragments by volume. The coarse fragments are residual rock fragments. Reaction is moderately acid or strongly acid.

The bedrock is granitic rock or low-grade metamorphic rock, such as slate or phyllite.

Jonas Series

The Jonas series consists of deep and very deep, well drained soils formed in colluvium and residuum derived from andesite or breccia and tuff. The colluvium and residuum have an admixture of volcanic ash. These soils are on mountain back slopes. Slopes are 15 to 90 percent. Elevation is 1,800 to 2,800 feet. The average annual precipitation is 60 to 90 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 140 to 160 days.

These soils are medial, frigid Andic Haplumbrepts.

Typical pedon of Jonas gravelly silt loam, 30 to 65 percent slopes, in Pierce County, about 6.5 miles southeast of Ohop, 2,200 feet east and 1,200 feet south of the northwest corner of sec. 18, T. 16 N., R. 6 E.

Oa—2 inches to 0; undecomposed needles, leaves, and twigs.

A1—0 to 7 inches; dark brown (7.5YR 3/2) gravelly silt loam, brown (7.5YR 5/2) dry; moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; weakly smeary; common very fine, fine, medium, and coarse roots; many very fine irregular pores; about 15 percent pebbles, 5 percent cobbles, and 10 percent shotlike aggregate; strongly acid; clear wavy boundary.

A2—7 to 16 inches; dark brown (10YR 3/3) gravelly silt loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine, fine, medium, and coarse roots; common very fine and fine irregular and tubular pores; about 20 percent pebbles and 5 percent cobbles; strongly acid; clear wavy boundary.

Bw1—16 to 34 inches; dark brown (10YR 3/3) gravelly clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; hard, firm, slightly sticky and plastic; weakly smeary; few very fine and fine roots; common very fine tubular pores; few thin, patchy clay films on faces of some peds; about 20 percent pebbles and 5 percent cobbles;

moderately acid; gradual wavy boundary.

Bw2—34 to 42 inches; dark brown (10YR 4/3) gravelly clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; hard, firm, slightly sticky and plastic; weakly smeary; few very fine roots; common very fine tubular pores; few thin, patchy clay films on faces of some peds; about 25 percent pebbles and 5 percent cobbles; moderately acid; clear wavy boundary.

C—42 to 60 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, yellowish brown (10YR 5/4) dry; massive; hard, firm, slightly sticky and slightly plastic; weakly smeary; few very fine tubular pores; about 30 percent pebbles and 2 percent cobbles; moderately acid.

The umbric epipedon is 15 to 36 inches thick. The depth to bedrock and the thickness of the solum range from 40 to more than 60 inches. The content of rock fragments in the particle-size control section ranges from 15 to 35 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is gravelly loam, gravelly clay loam, gravelly silt loam, or cobbly loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is gravelly clay loam, gravelly loam, or very gravelly loam.

Kaleetan Series

The Kaleetan series consists of deep and very deep, well drained soils formed in a mixture of volcanic ash and pumice over colluvium derived from andesite, tuff, breccia, and glacial till. These soils are on glacially modified mountain back slopes and toe slopes. Slopes are 8 to 65 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 100 to 120 inches, the average annual air temperature is about 44 degrees F. The frost-free period is 135 to 155 days.

These soils are loamy-skeletal, mixed, frigid Typic Haplohumods.

Typical pedon of Kaleetan sandy loam, 30 to 65 percent slopes, in King County, about 200 feet east of Cedar River Watershed Road 100, about 800 feet east and 2,200 feet south of the northwest corner of sec. 26, T. 22 N., R. 9 E.

Oi—4 to 3 inches; needles, moss, and twigs.

Oa—3 inches to 0; dark reddish brown (5YR 2.5/2), highly decomposed forest litter.

E—0 to 1.5 inches; brown (7.5YR 5/2) loamy sand (volcanic ash and pumice), pinkish gray (7.5YR 7/2) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; about 5 percent subangular pebbles; NaF pH less than 9.2; very strongly acid; abrupt wavy boundary.

Bhs—1.5 to 4 inches; variegated 70 percent dark reddish brown (5YR 3/3) and 30 percent yellowish red (5YR 5/6) sandy loam (volcanic ash and pumice), 70 percent reddish brown (5YR 4/4) and 30 percent reddish yellow (7.5YR 6/6) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; nonsmeary; common fine and medium roots; about 5 percent subangular pebbles; NaF pH 11.5; very strongly acid; abrupt broken boundary.

Bs1—4 to 9 inches; variegated 70 percent dark brown (7.5YR 4/4) and 30 percent yellowish red (5YR 5/8) gravelly sandy loam (volcanic ash), 70 percent reddish yellow (7.5YR 6/6) and 30 percent reddish yellow (7.5YR 6/8) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; about 20 percent subangular pebbles and 10 percent cobbles; NaF pH 12.0+; strongly acid; clear wavy boundary.

2Bs2—9 to 23 inches; brown (7.5YR 4/4) very gravelly sandy loam, light brown (7.5YR 6/4) dry; yellowish red (5YR 5/8) stains on rock fragments; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; about 35 percent subangular pebbles and 15 percent cobbles; NaF pH 12.0+; very strongly acid; gradual wavy boundary.

2BC—23 to 35 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, light yellowish brown (10YR 6/4) dry; yellowish red (5YR 5/8) stains on rock fragments; weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; about 45 percent subangular pebbles and 15 percent cobbles; NaF pH 12.0+; strongly acid; clear smooth boundary.

2C1—35 to 56 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, very pale brown (10YR 7/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; about 45 percent subangular pebbles and 15 percent cobbles; NaF pH 12.0+; moderately acid; clear wavy boundary.

2C2—56 to 60 inches; yellowish brown (10YR 5/4) extremely gravelly sandy loam, very pale brown

(10YR 7/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; about 60 percent subangular pebbles and 20 percent cobbles; NaF pH 12.0+; moderately acid.

Some areas are underlain by dense glacial till at a depth of 40 to 60 inches. The content of rock fragments in the particle-size control section ranges from 35 to 60 percent by volume.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 6 when moist and 5 to 8 when dry, and chroma of 1 or 2 when moist and dry.

The Bhs and Bs horizons have hue of 5YR or 7.5YR when moist and dry and are variegated. The Bs horizon is gravelly sandy loam or gravelly loam. It has 15 to 30 percent rock fragments by volume.

The 2Bs and 2BC horizons have hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 4 to 6 when moist and dry. They are very gravelly sandy loam or very gravelly loam. They have 35 to 60 percent rock fragments by volume. Reaction is very strongly acid or strongly acid.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6 when moist and 6 or 7 when dry, and chroma of 3 or 4 when moist and dry. It is very gravelly sandy loam, very gravelly loamy sand, extremely gravelly sandy loam, or extremely gravelly loamy sand. It has 50 to 80 percent rock fragments by volume.

Kanaskat Series

The Kanaskat series consists of very deep, well drained soils formed in a mixture of volcanic ash, colluvium, and material weathered from extrusive igneous rocks or tuff and breccia. These soils are on back slopes in the foothills. Slopes are 0 to 65 percent. Elevation is 1,000 to 1,700 feet. The average annual precipitation is 50 to 80 inches, and the mean annual air temperature is about 47 degrees F. The frost-free period is 145 to 165 days.

These soils are loamy-skeletal, mixed, mesic Typic Haplothods.

Typical pedon of Kanaskat gravelly sandy loam, 30 to 65 percent slopes, in King County, about 5 miles east of Palmer Junction, 200 feet east of Forest Service Road 5510, about 1,375 feet east and 1,060 feet south of the northwest corner of sec. 27, T. 21 N., R. 8 E.

Oi—2 inches to 1 inch; needles, leaves, and twigs; abrupt smooth boundary.

Oa—1 inch to 0; black (10YR 2/1), decomposed forest litter; abrupt smooth boundary.

A—0 to 11 inches; grayish brown (10YR 5/2) gravelly sandy loam (volcanic ash and cinders), pale brown (10YR 6/3) dry; weak fine subangular blocky

structure; soft, friable, nonsticky and nonplastic; weakly smeary; many very fine, fine, and medium and common coarse roots; about 20 percent pebbles, including weathered, hard cinders; strongly acid; abrupt wavy boundary.

2Bs—11 to 23 inches; dark yellowish brown (10YR 4/4) and strong brown (7.5YR 4/6) extremely gravelly loam, very pale brown (10YR 7/3) and reddish yellow (7.5YR 6/6) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; common very fine and fine and few medium roots; about 60 percent pebbles and 10 percent cobbles; moderately acid; clear smooth boundary.

2BC—23 to 38 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; common fine and few very fine and medium roots; about 50 percent pebbles and 10 percent cobbles; moderately acid; gradual smooth boundary.

2C—38 to 60 inches; light olive brown (2.5Y 5/4) extremely gravelly coarse sandy loam, light gray (2.5Y 7/2) dry; massive; hard, firm, slightly sticky and nonplastic; weakly smeary; few fine roots; about 60 percent pebbles and 10 percent cobbles; moderately acid.

The depth to paralithic contact is 55 to 72 inches. The particle-size control section ranges from 35 to 75 percent rock fragments by volume. Reaction is moderately acid or strongly acid throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry.

The 2Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 3 to 6 when moist. It is sandy loam or loam in the fine-earth fraction. It has 30 to 70 percent rock fragments and 0 to 10 percent hard cinders.

The 2BC horizon has value of 4 or 5 when moist and 6 or 7 when dry. It is sandy loam or loam in the fine-earth fraction. It has 40 to 60 percent pebble- and cobble-sized rock fragments.

The 2C horizon has hue of 2.5Y or 10YR, value of 6 or 7 when dry, and chroma of 4 to 6 when moist and 2 to 6 when dry. It is sandy loam or coarse sandy loam in the fine-earth fraction. It has 45 to 70 percent rock fragments.

Kapowsin Series

The Kapowsin series consists of moderately well drained soils formed in dense glacial till. These soils are

moderately deep to ortstein. They are on glacial till plains. Slopes are 6 to 65 percent. Elevation is 50 to 800 feet. The average annual precipitation is 35 to 50 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 160 to 180 days.

These soils are coarse-loamy, mixed, mesic, ortstein Aquic Haplorthods.

Typical pedon of Kapowsin gravelly loam, 15 to 30 percent slopes, in Pierce County, about 4 miles southeast of Orting, 2,400 feet south and 1,600 feet east of the northwest corner of sec. 11, T. 18 N., R. 5 E.

Oa—2 inches to 0.5 inch; undecomposed needles, leaves, and twigs.

Oi—0.5 inch to 0; decomposed organic mat.

A—0 to 9 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many fine irregular pores; about 25 percent pebbles and 5 percent cobbles; moderately acid; clear smooth boundary.

Bs1—9 to 24 inches; dark brown (10YR 4/3) gravelly loam, pale brown (10YR 6/3) dry; few fine prominent mottles, reddish brown (5YR 4/4) moist and dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; common very fine tubular pores; about 20 percent pebbles and 10 percent cobbles; moderately acid; gradual smooth boundary.

Bs2—24 to 37 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; few fine prominent mottles, reddish brown (5YR 4/4) moist and dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; common very fine tubular pores; about 20 percent pebbles and 10 percent cobbles; moderately acid; abrupt smooth boundary.

Bsm—37 to 60 inches; brown (10YR 5/3) ortstein that crushes to gravelly sandy loam, very pale brown (10YR 7/3) dry; massive; very hard, very firm, nonsticky and nonplastic; few fine tubular pores; about 25 percent pebbles; moderately acid.

The depth to ortstein ranges from 20 to 40 inches. The content of rock fragments in the particle-size control section ranges from 20 to 35 percent. It includes 0 to 10 percent cobbles.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist, and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 3 or 4 when moist and dry. It is gravelly loam, gravelly silt loam, or gravelly sandy loam.

The Bsm horizon is ortstein that crushes to gravelly loam or gravelly sandy loam. It has hue of 10YR or 2.5Y, value of 4 or 5 when moist, and chroma of 3 or 4 when moist and dry.

Kindy Series

The Kindy series consists of moderately well drained soils formed in a mixture of volcanic ash and colluvium over dense glacial till. These soils are moderately deep to ortstein. They are on glacially modified mountain back slopes and plateaus. Slopes are 0 to 65 percent. Elevation is 1,800 to 2,700 feet. The average annual precipitation is 75 to 90 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 95 to 115 days.

These soils are loamy-skeletal, mixed, ortstein Typic Cryorthods.

Typical pedon of Kindy gravelly loam, 30 to 65 percent slopes, in King County, about 2.5 miles west of Lost Lake, 1,200 feet west and 2,400 feet south of the northeast corner of sec. 1, T. 21 N., R. 10 E.

Oi—2 inches to 0; decomposed organic mat.

E—0 to 4 inches; brown (7.5YR 5/2) sandy loam, pinkish gray (7.5YR 7/2) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine roots; many fine irregular pores; about 10 percent pebbles; strongly acid; abrupt wavy boundary.

Bs1—4 to 10 inches; dark reddish brown (5YR 3/3) and yellowish red (5YR 4/6) gravelly silt loam, reddish brown (5YR 4/3) and yellowish red (5YR 5/6) dry; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium and coarse roots; many very fine irregular pores; about 30 percent pebbles; strongly acid; abrupt wavy boundary.

Bs2—10 to 14 inches; dark brown (7.5YR 4/4) very gravelly loam, brown (7.5YR 5/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine, fine, and medium roots; many very fine irregular pores; about 40 percent pebbles and 10 percent cobbles; strongly acid; clear wavy boundary.

Bs3—14 to 23 inches; dark yellowish brown (10YR 4/6)

very gravelly loam, yellowish brown (10YR 5/6) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine, fine, and medium roots; many very fine irregular pores; about 40 percent pebbles and 10 percent cobbles; strongly acid; clear smooth boundary.

BC—23 to 32 inches; brown (10YR 5/3) and strong brown (7.5YR 5/6) very gravelly sandy loam, pale brown (10YR 6/3) and reddish yellow (7.5YR 6/6) dry; moderate medium subangular blocky structure; hard, very firm, slightly sticky and nonplastic; weakly smeary; few fine roots; many very fine irregular pores; about 50 percent pebbles and 10 percent cobbles; strongly acid; abrupt wavy boundary.

2Bsm—32 to 40 inches; dark grayish brown (2.5Y 4/2) ortstein that crushes to very gravelly sandy loam, grayish brown (2.5Y 5/2) dry; massive; extremely hard, extremely firm, slightly sticky and nonplastic; about 50 percent pebbles; moderately acid.

The depth to ortstein ranges from 20 to 40 inches. The content of rock fragments in the particle-size control section ranges from 35 to 60 percent. It includes 0 to 10 percent pebbles.

The E horizon has hue of 5YR, 7.5YR, or 10YR, value of 5 or 6 when moist and 6 or 7 when dry, and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 4 to 6 when moist and dry. It is gravelly loam, gravelly silt loam, very gravelly loam, or very gravelly silt loam.

The BC horizon has hue of 7.5YR to 2.5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 3 to 6 when moist and dry. It is very gravelly loam or very gravelly sandy loam.

The 2Bsm horizon is ortstein that crushes to very gravelly loam or very gravelly sandy loam. It has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry.

Klaber Series

The Klaber series consists of very deep, poorly drained soils formed in lacustrine sediments. These soils are on terraces. Slopes are 0 to 8 percent. Elevation is 100 to 1,000 feet. The average annual precipitation is 50 to 60 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 165 to 185 days.

These soils are fine, mixed, mesic Typic Glossaqualfs.

Typical pedon of Klaber silt loam, 0 to 8 percent slopes, in Pierce County, about 1 mile north of Ohop, 1,300 feet north and 1,700 feet west of the southeast corner of sec. 17, T. 17 N., R. 5 E.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; strong medium and coarse granular structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; many very fine irregular pores; very strongly acid; abrupt smooth boundary.

AEg—3 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 6/1) dry; strong medium granular structure; very hard, firm, slightly sticky and slightly plastic; common fine and few medium roots; many fine irregular pores; very strongly acid; abrupt smooth boundary.

E/Bg—11 to 22 inches; light brownish gray (2.5Y 6/2) silt loam, light gray (10YR 7/2) dry; common medium prominent mottles, strong brown (7.5YR 5/8) moist and dry; moderate medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine and fine tubular pores; very strongly acid; clear smooth boundary.

Btg1—22 to 36 inches; grayish brown (10YR 5/2) silty clay, light gray (2.5Y 7/2) dry; common medium prominent mottles, strong brown (7.5YR 5/6) moist and dry; moderate medium and coarse angular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; many fine and medium tubular pores; many thin and moderately thick clay films on faces of peds; strongly acid; clear smooth boundary.

Btg2—36 to 60 inches; gray (5Y 6/1) silty clay, white (5Y 8/1) dry; massive in place but parting to moderate thick plates when removed; extremely hard, extremely firm, sticky and plastic; common thin clay films on faces of peds in the upper part; strongly acid.

The content of clay in the particle-size control section ranges from 35 to 42 percent. The thickness of the solum is 15 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry. The E/Bg horizon has hue of 10YR or 2.5Y and value of 4 to 6 when moist and 6 or 7 when dry. It is silt loam or silty clay loam. The Btg1 horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 to 8 when dry, and chroma of 1 or 2 when moist and dry. It is silty clay or clay.

Klapatche Series

The Klapatche series consists of well drained soils formed in a mixture of volcanic ash and pumice over colluvium derived from granitic and metamorphic rocks. These soils are moderately deep to bedrock. They are on glacially modified mountain ridge crests and back slopes. Slopes are 8 to 90 percent. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 70 to 110 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 110 to 130 days.

These soils are sandy-skeletal, mixed Haplic Cryohumods.

Typical pedon of Klapatche loamy sand, 30 to 65 percent slopes, in King County, about 7 miles east of Chester Morse Lake, 500 feet south and 1,400 feet west of the northeast corner of sec. 22, T. 22 N., R. 10 E.

Oi—2 to 1.5 inches; loose forest litter, including needles, twigs, bark, and moss.

Oa—1.5 inches to 0; black (10YR 2/1), decomposed forest litter bound by common fine and very fine roots; abrupt smooth boundary.

E—0 to 3 inches; pinkish gray (7.5YR 6/2) loamy sand (volcanic ash and pumice), light gray (N 7/0) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many fine interstitial pores; about 5 percent pebbles; very strongly acid; abrupt irregular boundary.

B&E—3 to 8 inches; variegated dark reddish brown (5YR 3/3), dark brown (7.5YR 4/4), and light gray (10YR 7/1) loamy sand (volcanic ash and pumice), variegated reddish brown (5YR 4/4), reddish yellow (7.5YR 6/6), and light gray (10YR 7/1) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, common medium, and few coarse roots; many fine interstitial pores; about 10 percent pebbles and hard cinders; moderately acid; abrupt wavy boundary.

Bhs—8 to 12 inches; yellowish red (5YR 5/6) and dark reddish brown (2.5YR 3/4) very gravelly sandy loam, reddish yellow (7.5YR 6/6) dry; strong medium subangular blocky structure; hard, friable, slightly sticky and nonplastic; weakly smeary; common fine and few medium roots; common fine random tubular pores; about 40 percent pebbles and hard cinders; moderately acid; clear wavy boundary.

2Bs—12 to 20 inches; strong brown (7.5YR 5/6) very gravelly loamy sand, light yellowish brown (10YR

6/4) dry; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common fine random tubular pores; about 10 percent cobbles and 35 percent pebbles; moderately acid; clear smooth boundary.

2C—20 to 31 inches; very pale brown (10YR 7/4) extremely cobbly sand, light gray (10YR 7/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; many fine and medium interstitial pores; about 25 percent pebbles and 40 percent cobbles; strongly acid; gradual smooth boundary.

2Cr—31 to 38 inches; light gray (10YR 7/1), highly weathered granodiorite, pale yellow (2.5Y 7/4) dry; can be cut by a spade with difficulty and breaks to very gravelly coarse sand; about 50 percent hard gravel and 10 percent hard cobbles; moderately acid.

2R—38 inches; hard granodiorite.

The depth to paralithic contact is 20 to 40 inches. Hard, consolidated bedrock is at a depth of about 30 to 40 inches. The bedrock is granitic rock or metamorphic rock, mainly slate and phyllite. The content of hard rock fragments, including hard cinders, in the particle-size control section ranges from 35 to 70 percent by volume.

The E horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 3 to 7 when moist and 6 to 8 when dry and chroma of 0 to 2 when moist and dry. Reaction is moderately acid to very strongly acid. The B&E horizon has colors similar to those of the Bhs and E horizons.

The Bhs horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 3 to 6 when moist and dry. It has as much as 35 percent coarse volcanic ash and pumice by volume. It is loamy sand, sandy loam, or silt loam in the fine-earth fraction. It has 15 to 50 percent pebbles and hard cinders. Most of the pebbles in this horizon are less than 5 millimeters in diameter. Reaction is moderately acid or strongly acid.

The 2Bs horizon has value of 4 to 7 when moist and chroma of 2 to 6 when moist and dry. It is very gravelly loamy sand, gravelly sandy loam, very cobbly loamy sand, extremely gravelly sand, or very cobbly sand. It has 15 to 50 percent pebbles and 5 to 30 percent cobbles. Reaction is moderately acid or strongly acid.

The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 when moist and dry, and chroma of 1 to 4 when dry and moist. It is extremely cobbly sand, very cobbly sand, or extremely gravelly sand. It has 40 to 70 percent rock fragments. Reaction is moderately acid or strongly acid.

Klaus Series

The Klaus series consists of moderately deep, well drained soils formed in a mixture of volcanic ash and alluvium over glacial outwash. These soils are on terraces and terrace escarpments. Slopes are 0 to 65 percent. Elevation is 700 to 1,400 feet. The average annual precipitation is 80 to 100 inches, and the mean annual temperature is about 50 degrees F. The frost-free period is 145 to 165 days.

These soils are sandy-skeletal, mixed, mesic, ortstein Typic Haplorthods.

Typical pedon of Klaus sandy loam, 0 to 8 percent slopes, in King County, about 3 miles east of North Bend, 500 feet east and 1,300 feet north of the southwest corner of sec. 7, T. 23 N., R. 9 E.

- Oi—2.5 to 1.5 inches; undecomposed forest litter and moss; abrupt smooth boundary.
- Oa—1.5 inches to 0; black (10YR 2/1), soft, decomposed litter and moss bound by roots; abrupt smooth boundary.
- E—0 to 2 inches; grayish brown (2.5Y 5/2) loamy sand (volcanic ash), gray (N 6/0) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine and few medium roots; many very fine and fine discontinuous pores; about 10 percent pebbles and 10 percent pumiceous ash 2 millimeters or less in diameter; strongly acid; abrupt smooth boundary.
- Bhs—2 to 7 inches; dark reddish brown (5YR 3/3) sandy loam, brown (7.5YR 5/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; common fine and few medium and coarse roots; many very fine and fine discontinuous pores; about 10 percent pebbles and 10 percent pumiceous ash 2 millimeters or less in diameter; strongly acid; abrupt smooth boundary.
- Bs—7 to 16 inches; dark brown (7.5YR 3/4) gravelly sandy loam, yellowish brown (10YR 5/6) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium roots; many very fine and fine discontinuous pores; about 20 percent pebbles and 5 percent cobbles; strongly acid; abrupt smooth boundary.
- 2BC—16 to 28 inches; brown (10YR 4/3) very gravelly sand, light brownish gray (2.5Y 6/2) dry; single grain; loose; common fine and medium roots; many very fine and fine discontinuous pores; 50 percent pebbles and 10 percent cobbles; moderately acid; clear smooth boundary.

- 2Bsm—28 to 43 inches; brown (10YR 4/3) extremely gravelly sand, light yellowish brown (2.5Y 6/4) dry; massive; extremely hard, extremely firm, nonsticky and nonplastic; weakly cemented; about 60 percent pebbles, 10 percent cobbles, and 10 percent stones; moderately acid; gradual smooth boundary.
- 2C—43 to 60 inches; brown (10YR 4/3) extremely gravelly sand, light yellowish brown (2.5Y 6/4) dry; single grain; loose; about 60 percent pebbles, 10 percent cobbles, and 10 percent stones; moderately acid.

Depth to the 2BC horizon is 12 to 30 inches. Depth to the iron-cemented 2Bsm horizon ranges from 20 to 40 inches.

The E horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 3 to 5 when moist and 4 to 6 when dry and chroma of 2 to 4 when moist and 0 to 3 when dry. It has 10 to 45 percent pumice or pumiceous volcanic ash and 10 to 15 percent pebbles. Reaction is very strongly acid or strongly acid.

The Bhs and Bs horizons have hue of 5YR, 7.5YR, or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and 4 to 6 when dry. They have 10 to 45 percent pumiceous ash, 10 to 20 percent other volcanic ash, 10 to 30 percent pebbles, and 0 to 5 percent cobbles. Reaction is very strongly acid or strongly acid.

The 2BC horizon has hue of 10YR, 2.5Y, or 7.5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 to 6 when moist and dry. It is very gravelly loamy sand, very gravelly sand, or extremely gravelly sand. It has 35 to 60 percent pebbles, 5 to 20 percent cobbles, and 0 to 10 percent stones. Reaction is strongly acid or moderately acid.

The 2Bsm and 2C horizons have colors and textures similar to those of the 2BC horizon. The 2Bsm horizon is weakly cemented with iron and extremely hard to break when in place. When removed, it can be easily broken by hand.

Larrupin Series

The Larrupin series consists of deep and very deep, well drained soils formed in volcanic ash and pumice over volcanic mudflow or over andesitic block-and-ash flow and dense lahar. These soils are on valley bottoms and on the adjacent mountain back slopes. Slopes are 3 to 65 percent slopes. Elevation is 1,700 to 2,800 feet. The average annual precipitation is 60 to 90 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 135 to 155 days.

These soils are loamy-skeletal, mixed, frigid Typic Haplorthods.

Typical pedon of Larrupin loamy sand, 30 to 65 percent slopes, in Pierce County, about 1 mile south of Old Baldy Mountain, 150 feet north of Forest Service Road 1811, about 2,000 feet east and 3,700 feet south of the northwest corner of sec. 34, T. 18 N., R. 7 E.

Oi—7 to 5 inches; needles, twigs, and moss.

Oa—5 inches to 0; dark gray (N 4/0), decomposed organic material; few fine, medium, and coarse roots.

A—0 to 6 inches; dark brown (10YR 4/3) loamy sand (65 percent volcanic ash and pumice), pale brown (10YR 6/3) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine and few medium roots; about 10 percent subrounded and rounded pebbles; slightly acid; clear wavy boundary.

2Bs—6 to 24 inches; dark yellowish brown (10YR 3/4) gravelly sandy loam (30 percent volcanic ash and pumice), light yellowish brown (10YR 6/4) dry; single grain; loose; many fine and few medium and coarse roots; about 25 percent subrounded and rounded pebbles; slightly acid; clear smooth boundary.

2BC—24 to 35 inches; dark yellowish brown (10YR 4/6) very gravelly sandy loam, brownish yellow (10YR 6/6) dry; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few fine and medium roots; about 30 percent pebbles and 10 percent cobbles; slightly acid; clear irregular boundary.

2C—35 to 60 inches; yellowish brown (10YR 5/6) very gravelly sandy loam, yellow (10YR 7/6) dry; single grain; loose; about 40 percent pebbles and 10 percent cobbles; slightly acid.

In some areas dense lahar material is at a depth of 40 to 60 inches. The thickness of the solum is 20 to 40 inches. The content of rock fragments in the particle-size control section ranges from 35 to 50 percent by volume.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry and chroma of 2 or 3 when moist and dry.

The 2Bs horizon has hue of 7.5YR or 10YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist and dry. It is sandy loam or loamy sand in the fine-earth fraction. It has 10 to 35 percent coarse fragments by volume.

The 2BC horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 4 to 6 when moist and dry. It has 30 to 45 percent pebbles and 5 to 15 percent cobbles by volume.

The 2C horizon has hue of 10YR or 2.5Y, value of 4

or 5 when moist and 5 to 7 when dry, and chroma of 2 to 6 when moist and dry. It is sandy loam or loamy sand in the fine-earth fraction. It has 35 to 60 percent coarse fragments.

Lemolo Series

The Lemolo series consists of very deep, poorly drained soils formed in the Osceola mudflow. These soils are on terraces. Slopes are 0 to 8 percent. Elevation is 750 to 1,600 feet. The average annual precipitation is 50 to 60 inches, and the mean annual air temperature is about 48 degrees F. The frost-free period is 170 to 180 days.

These soils are loamy-skeletal, mixed, nonacid, mesic Typic Humaquepts.

Typical pedon of Lemolo silt loam, 0 to 8 percent slopes, in King County, about 5 miles southeast of Enumclaw, 2,400 feet north and 1,050 feet west of the southeast corner of sec. 3, T. 19 N., R. 7 E.

Oi—6 to 5 inches; moss and undecomposed needles and twigs; abrupt smooth boundary.

Oa—5 inches to 0; black (10YR 2/1), well decomposed organic material, very dark brown (10YR 2/2) after rubbing; many very fine, fine, medium, and coarse roots; extremely acid; clear smooth boundary.

A—0 to 5 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; very strongly acid; clear smooth boundary.

Bg—5 to 17 inches; very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; soft, friable, slightly sticky and plastic; few fine and medium roots; about 15 percent pebbles; very strongly acid; abrupt irregular boundary.

2Cg1—17 to 34 inches; grayish brown (10YR 5/2) very gravelly sandy clay loam, light gray (10YR 7/2) dry; many large prominent dark brown (7.5YR 3/4), strong brown (7.5YR 4/6), and dark reddish brown (5YR 3/4) mottles; massive; slightly hard, firm, slightly sticky and slightly plastic; about 50 percent pebbles and 10 percent cobbles; moderately acid; clear smooth boundary.

2Cg2—34 to 60 inches; gray (10YR 5/1) very gravelly sandy clay loam, light gray (10YR 7/2) dry; common medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; about 50 percent pebbles and 10 percent cobbles; moderately acid.

Depth to the 2Cg horizon is 16 to 25 inches. The content of coarse fragments in the particle-size control section ranges from 50 to 70 percent by volume.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and chroma of 1 or 2 when moist and dry. It is loam or silt loam in the lower part. Reaction is very strongly acid or strongly acid.

The 2Cg horizon has hue of 10YR or 2.5YR, value of 5 or 6 when moist, and chroma of 1 or 2 when moist and dry. It is very gravelly or extremely gravelly sandy loam or very gravelly or extremely gravelly sandy clay loam. Reaction is moderately acid or slightly acid.

Littlejohn Series

The Littlejohn series consists of well drained soils formed in a mixture of volcanic ash and pumice over residuum and colluvium derived from extrusive igneous rocks. These soils are moderately deep to bedrock. They are on mountain back slopes and ridges. Slopes are 8 to 90 percent. Elevation is 1,700 to 2,800 feet. The average annual precipitation is 60 to 80 inches, and the mean annual air temperature is about 45 degrees F. The frost-free period is 150 to 170 days.

These soils are loamy-skeletal, mixed, frigid Typic Haplorthods.

Typical pedon of Littlejohn gravelly sandy loam, 8 to 30 percent slopes, in Pierce County, about 5 miles east of Carbonado, 135 feet north and 800 feet east of the southwest corner of sec. 5, T. 18 N., R. 7 E.

Oi—2 inches to 1 inch; undecomposed forest litter and moss; abrupt smooth boundary.

Oa—1 inch to 0; black (10YR 2/1), decomposed forest litter; abrupt smooth boundary.

A—0 to 11 inches; dark yellowish brown (10YR 3/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) dry; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium roots; about 15 percent pebbles, 5 percent cobbles, and 15 percent pumiceous ash; moderately acid; clear wavy boundary.

2Bs—11 to 17 inches; dark yellowish brown (10YR 3/4) very gravelly loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; many fine and common medium and coarse roots; about 25 percent pebbles, 10 percent cobbles, and 10 percent pumiceous ash; moderately acid; abrupt wavy boundary.

2C—17 to 30 inches; olive brown (2.5Y 4/4) very gravelly loam, light yellowish brown (2.5Y 6/4) dry;

weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; common fine and few medium and coarse roots; about 40 percent pebbles, 15 percent cobbles, and 5 percent stones; moderately acid; abrupt wavy boundary.

2R—30 inches; fractured andesite.

The depth to lithic contact is 25 to 40 inches. The upper 7 to 14 inches has more than 60 percent volcanic ash. In the control section, the content of rock fragments is 35 to 60 percent and the content of pumice is 0 to 20 percent.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist and dry. Subhorizons that have value and chroma of 3 are less than 7 inches thick. Reaction is strongly acid or moderately acid.

The 2Bs horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is gravelly loam, gravelly sandy loam, very gravelly loam, or very gravelly sandy loam. It has 10 to 50 percent gravel, 5 to 10 percent cobbles, and 10 to 35 percent volcanic ash.

The 2C horizon has hue of 10YR or 2.5Y and value of 4 or 5 when moist and 5 or 6 when dry. It is very gravelly loam, very gravelly sandy loam, extremely gravelly sandy loam, or extremely gravelly loam. It has 35 to 60 percent pebbles and 10 to 20 percent cobbles.

Lynnwood Series

The Lynnwood series consists of very deep, somewhat excessively drained soils formed in glacial outwash. These soils are on outwash terraces. Slopes are 6 to 45 percent. Elevation is 50 to 500 feet. The average annual precipitation is 40 to 55 inches, and the mean annual air temperature is about 49 degrees F. The frost-free period is 180 to 200 days.

These soils are sandy, mixed, mesic Entic Haplorthods.

Typical pedon of Lynnwood loamy fine sand, 6 to 15 percent slopes, in Pierce County, about 3 miles south of Buckley, 1,900 feet north and 1,500 feet east of the southwest corner of sec. 22, T. 19 N., R. 6 E.

Oi—3 to 2 inches; undecomposed needles, leaves, and twigs.

Oa—2 inches to 0; decomposed organic mat.

A—0 to 3 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and

common medium and coarse roots; many very fine irregular pores; moderately acid; abrupt smooth boundary.

Bs1—3 to 11 inches; dark yellowish brown (10YR 3/4) loamy fine sand, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many fine irregular pores; about 5 percent pebbles; moderately acid; clear smooth boundary.

Bs2—11 to 21 inches; dark yellowish brown (10YR 3/4) loamy fine sand, yellowish brown (10YR 5/4) dry; massive; loose; common very fine, fine, and medium and few coarse roots; many fine irregular pores; slightly acid; clear smooth boundary.

BC—21 to 26 inches; olive brown (2.5Y 4/4) fine sand, pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) dry; loose; few fine roots; many fine irregular pores; moderately acid; gradual smooth boundary.

C1—26 to 33 inches; olive (5Y 4/4) fine sand, pale olive (5Y 6/3) dry; loose; many fine irregular pores; moderately acid; clear smooth boundary.

C2—33 to 60 inches; olive (5Y 4/3) fine sand, olive (5Y 5/3) dry; loose; many fine irregular pores; moderately acid.

The thickness of the solum is 20 to 36 inches. The content of rock fragments in the particle-size control section ranges from 0 to 10 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist and dry. It is loamy fine sand or sand.

The BC and C horizons have hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry.

Marblemount Series

The Marblemount series consists of moderately deep, well drained soils formed in a mixture of volcanic ash, glacial till, and colluvium derived from granite and low-grade metamorphic rock. These soils are on glaciated mountain back slopes. Slopes are 8 to 90 percent. Elevation is 1,700 to 2,800 feet. The average annual precipitation is 70 to 120 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 110 to 130 days.

These soils are sandy-skeletal, mixed, frigid Typic Haplorthods.

Typical pedon of Marblemount gravelly loamy sand, 30 to 65 percent slopes, in King County, about 4 miles northeast of Chester Morse Lake, 100 feet south and 1,600 feet west of the northeast corner of sec. 7, T. 22 N., R. 10 E.

Oa—2 inches to 0.5 inch; decomposed needles and twigs.

Oi—0.5 inch to 0; decomposed organic mat.

E—0 to 2 inches; dark grayish brown (10YR 4/2) loamy sand (volcanic ash and pumice), light gray (10YR 7/2) dry; single grain; loose; weakly smeary; common very fine, fine, and medium roots; about 5 percent pebbles and 5 percent cinders; NaF pH 11.5; strongly acid; abrupt wavy boundary.

Bs1—2 to 5 inches; variegated dark reddish brown (5YR 3/4) and yellowish red (5YR 5/8) gravelly loamy sand (volcanic ash and pumice), brown (7.5YR 5/4) and reddish yellow (7.5YR 6/6) dry; single grain; loose; weakly smeary; common very fine and fine roots; about 10 percent pebbles and 5 percent cinders; NaF pH 12.0; moderately acid; gradual wavy boundary.

Bs2—5 to 22 inches; variegated reddish brown (5YR 4/4) and strong brown (7.5YR 5/8) very gravelly loamy sand, brown (7.5YR 5/4) and reddish yellow (7.5YR 6/6) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; about 30 percent pebbles and 5 percent cobbles; NaF pH 12.0; moderately acid; gradual wavy boundary.

BC—22 to 35 inches; brown (7.5YR 4/4) extremely gravelly loamy sand, light brown (7.5YR 6/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; about 45 percent pebbles and 20 percent cobbles; NaF pH 12.0; moderately acid; abrupt wavy boundary.

Cr—35 inches; fractured granodiorite.

The depth to bedrock is 20 to 40 inches. The content of rock fragments in the particle-size control section is 35 to 60 percent. It includes 0 to 10 percent cinders and 0 to 10 percent cobbles.

The E horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 to 5 when moist and 5 or 6 when dry, and chroma of 4 to 8 when moist and dry. It is loamy sand, gravelly loamy sand, or very gravelly loamy sand.

The BC horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 4 to 6 when moist and dry. It is very gravelly

loamy sand, extremely gravelly loamy sand, or extremely gravelly sand.

Mashel Series

The Mashel series consists of very deep, moderately well drained soils formed in glacial till. These soils are on back slopes in the foothills. Slopes are 5 to 65 percent. Elevation is 700 to 1,800 feet. The average annual precipitation is 50 to 60 inches, and the mean annual air temperature is about 49 degrees F. The frost-free period is 180 to 200 days.

These soils are fine, halloysitic, mesic Ultic Haploxeralfs.

Typical pedon of Mashel silt loam, 5 to 30 percent slopes, in Pierce County, about 4 miles east of Lake Kapowsin, 700 feet north and 700 feet west of the southeast corner of sec. 11, T. 17 N., R. 5 E.

Oi—3 inches to 0; undecomposed organic mat; few very fine, fine, and medium roots.

A—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; moderate medium granular structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many very fine irregular pores; about 5 percent pebbles; moderately acid; clear smooth boundary.

BA—7 to 13 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; strong medium subangular blocky structure; hard, firm, slightly sticky and plastic; common very fine and fine and few medium and coarse roots; many very fine irregular pores; about 5 percent pebbles; moderately acid; clear smooth boundary.

Bt1—13 to 22 inches; brown (10YR 5/3) silty clay loam, pale yellow (2.5Y 7/4) dry; common coarse distinct dark yellowish brown (10YR 4/4) mottles, brownish yellow (10YR 6/6) dry; strong medium subangular blocky structure; hard, very firm, sticky and plastic; common very fine and fine and few coarse roots; many very fine irregular pores; about 5 percent pebbles; few thick clay films on faces of peds; moderately acid; clear smooth boundary.

Bt2—22 to 30 inches; brown (10YR 5/3) silty clay, light gray (2.5Y 7/2) dry; many coarse distinct strong brown (7.5YR 5/6) mottles; strong medium subangular blocky structure; hard, firm, sticky and plastic; many very fine irregular pores; about 10 percent pebbles; few thick clay films on faces of peds; moderately acid; clear smooth boundary.

BCt1—30 to 48 inches; grayish brown (10YR 5/2) silty clay, very pale brown (10YR 7/4) dry; common medium distinct yellowish brown (10YR 5/6) mottles,

strong brown (7.5YR 5/6) dry; strong medium subangular blocky structure; hard, firm, sticky and plastic; common very fine irregular pores; about 10 percent pebbles; few thick clay films on faces of peds; moderately acid; clear smooth boundary.

BCt2—48 to 60 inches; grayish brown (10YR 5/2) silty clay, light gray (10YR 7/2) dry; common medium distinct yellowish brown (10YR 5/6) mottles, strong brown (7.5YR 5/8) dry; massive; hard, firm, sticky and plastic; common very fine irregular pores; about 10 percent pebbles; few thick clay films on faces of peds; moderately acid.

In the particle-size control section, the content of clay is 35 to 45 percent and the content of rock fragments is 5 to 15 percent.

The A horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist and dry.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 2 to 4 when moist and dry. It is silty clay loam or silty clay.

The BCt horizon has hue of 10YR or 2.5Y, value of 5 or 6 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is silty clay loam or silty clay.

Melakwa Series

The Melakwa series consists of moderately deep, well drained soils formed in a mixture of volcanic ash and pumice over colluvium derived from andesite or breccia and tuff. These soils are on glacially modified mountain back slopes and toe slopes. Slopes are 8 to 90 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 90 to 130 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 135 to 155 days.

These soils are loamy-skeletal, mixed, frigid Typic Haplohumods.

Typical pedon of Melakwa sandy loam, 30 to 65 percent slopes, in King County, about 0.5 mile south of Chester Morse Lake, along Little Mountain Road, in the Cedar River watershed, 2,150 feet west and 2,950 feet north of the southeast corner of sec. 20, T. 22 N., R. 9 E.

Oi—3 inches to 1 inch; moss, needles, and twigs.

Oa—1 inch to 0; decomposed forest litter.

E—0 to 3 inches; reddish gray (5YR 5/2) loamy sand (volcanic ash and pumice), light gray (5YR 7/1) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; nonsmeary; many

very fine and fine and few medium and coarse roots; about 5 percent subangular pebbles; NaF pH less than 9.2; very strongly acid; abrupt wavy boundary.

Bhs—3 to 7 inches; dark reddish brown (5YR 3/4) sandy loam (volcanic ash and pumice), yellowish red (5YR 4/6) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine and few medium and coarse roots; about 10 percent subangular pebbles; NaF pH 12.0+; very strongly acid; abrupt wavy boundary.

2Bs—7 to 13 inches; dark brown (7.5YR 4/4) very gravelly sandy loam, brown (7.5YR 5/4) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and few medium and coarse roots; about 40 percent pebbles and 10 percent cobbles; NaF pH 12.0+; strongly acid; clear wavy boundary.

2BCs—13 to 22 inches; dark yellowish brown (10YR 4/4) very gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine roots; few very fine interstitial pores; about 40 percent pebbles and 20 percent cobbles; NaF pH 12.0+; strongly acid; gradual wavy boundary.

2BC—22 to 31 inches; olive brown (2.5Y 4/4) very gravelly loam, light yellowish brown (2.5Y 6/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few coarse roots; few very fine interstitial pores; about 40 percent pebbles and 20 percent cobbles; NaF pH 11.0; strongly acid; abrupt wavy boundary.

2C—31 to 37 inches; light olive brown (2.5Y 5/4) extremely gravelly loam, pale yellow (2.5Y 7/4) dry; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; weakly smeary; few very fine interstitial pores; about 50 percent pebbles and 20 percent cobbles; NaF pH 11.5; strongly acid; abrupt wavy boundary.

2R—37 inches; hard fractured andesite.

The depth to lithic contact is 20 to 40 inches. The content of rock fragments, including hard cinders, in the control section is 35 to 70 percent by volume.

The E horizon has hue of 5YR or 7.5YR or is neutral in hue. It has value of 4 to 6 when moist and 5 to 7 when dry and chroma of 0 to 2 when moist and dry. The content of rock fragments, including hard cinders, is 0 to 10 percent by volume.

The Bhs horizon has hue of 5YR or 7.5YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist and 4 to 6 when dry. It has 10 to 30 percent rock fragments, including hard cinders, by volume.

The 2Bs horizon has hue of 5YR or 7.5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is very gravelly sandy loam or very gravelly loam. It has 35 to 60 percent rock fragments by volume.

The 2BCs horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 4 to 6 when moist and dry. It is very gravelly sandy loam or very gravelly loam. The content of rock fragments is 35 to 60 percent by volume.

The 2BC and 2C horizons have hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 3 or 4 when moist and dry. They are loam or sandy loam in the fine-earth fraction. They have 50 to 80 percent rock fragments by volume.

Mowich Series

The Mowich series consists of very deep, somewhat poorly drained soils formed in volcanic ash over glaciolacustrine sediments. These soils are on proglacial lake plains. Slopes are 0 to 15 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 55 to 75 inches, and the mean annual air temperature is about 45 degrees F. The frost-free period is 150 to 170 days.

These soils are loamy over clayey, mixed, frigid Aquic Haplorthods.

Typical pedon of Mowich silt loam, 0 to 15 percent slopes, in Pierce County, about 3.5 miles southeast of Ohop, 150 feet south of St. Regis Paper Company Road 0-6011, about 1,600 feet east and 800 feet south of the northwest corner of sec. 35, T. 17 N., R. 5 E.

Oi—8 to 5 inches; needles, twigs, leaves, and moss.

Oa—5 inches to 0; decomposed forest litter; many very fine, fine, and medium roots; abrupt smooth boundary.

A—0 to 7 inches; dark brown (7.5YR 3/2) silt loam, brown (7.5YR 5/2) dry; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; many very fine, fine, medium, and coarse roots; common very fine tubular pores; very strongly acid; abrupt wavy boundary.

Bs1—7 to 10 inches; strong brown (7.5YR 5/6) silt loam, reddish yellow (7.5YR 6/6) dry; reddish brown (5YR 4/4) iron oxide coatings on 20 percent of the ped faces; moderate fine and medium subangular

blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; common very fine and fine roots; common very fine tubular pores; very strongly acid; clear wavy boundary.

Bs2—10 to 26 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; common fine distinct yellowish red (5YR 4/6) and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; few very fine and fine roots; many very fine tubular pores; very strongly acid; clear smooth boundary.

2Cg—26 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, light gray (2.5Y 7/2) dry; many fine and medium prominent yellowish red (5YR 5/8) mottles; massive; very hard, firm, sticky and plastic; few very fine tubular pores; very strongly acid.

The content of coarse fragments in the control section is 0 to 15 percent by volume. Reaction is very strongly acid or strongly acid throughout the profile.

The A horizon has hue of 7.5YR or 10YR when moist and dry, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry.

The Bs1 horizon has hue of 5YR or 7.5YR when moist and dry, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry.

The Bs2 horizon has value of 4 to 6 when moist and 5 to 7 when dry and chroma of 2 to 4 when moist and dry. It is silt loam or silty clay loam.

The 2Cg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 when moist and 6 to 8 when dry, and chroma of 1 or 2 when moist and dry. It is silty clay or clay.

Mukilteo Series

The Mukilteo series consists of very deep, very poorly drained soils formed in herbaceous and woody organic material. These soils are in bogs. Slopes are 0 to 1 percent. Elevation is 600 to 1,000 feet. The average annual precipitation is 40 to 55 inches, and the mean annual temperature is about 50 degrees F. The frost-free period is 160 to 180 days.

These soils are dysic, mesic Typic Medihemists.

Typical pedon of Mukilteo peat, 0 to 1 percent slopes, in King County, about 2 miles northwest of Solleck, about 500 feet east and 2,500 feet north of the southwest corner of sec. 15, T. 22 N., R. 7 E.

Oi—0 to 10 inches; dark brown (7.5YR 3/4) peat, dark brown (7.5YR 4/4) dry; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many

very fine and fine roots; many very fine irregular pores; about 90 percent fiber before rubbing and 40 percent after rubbing; very strongly acid; clear smooth boundary.

Oe1—10 to 40 inches; dark brown (7.5YR 3/4) hemic material, dark brown (7.5YR 4/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine irregular pores; about 90 percent fiber before rubbing and 40 percent after rubbing; very strongly acid; clear smooth boundary.

Oe2—40 to 60 inches; dark reddish brown (5YR 3/3) hemic material, reddish brown (5YR 4/3) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine irregular pores; about 80 percent fiber before rubbing and 45 percent after rubbing; very strongly acid.

The content of fiber in the control section is 70 to 90 percent before rubbing and 40 to 50 percent after rubbing. The surface tier has hue of 5YR or 7.5YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist and dry. The subsurface tier has hue of 5YR or 7.5YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist and dry.

Nagrom Series

The Nagrom series consists of well drained soils formed in volcanic ash and pumice over residuum and colluvium derived from extrusive igneous rocks or breccia and tuff. These soils are moderately deep to fractured bedrock. They are on ridge crests and mountain back slopes. Slopes are 8 to 90 percent. Elevation is 2,400 to 3,600 feet. The average annual precipitation is 75 to 100 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 110 to 130 days.

These soils are loamy-skeletal, mixed Haplic Cryohumods.

Typical pedon of Nagrom sandy loam, 8 to 30 percent slopes, in King County, about 9 miles east of Enumclaw, on a spur ridge off Grass Mountain, 1,300 feet west and 400 feet south of the northeast corner of sec. 20, T. 20 N., R. 8 E.

Oi—1.5 inches to 0.5 inch; leaves, needles, twigs, and moss; abrupt smooth boundary.

Oa—0.5 inch to 0; decomposed organic litter; abrupt smooth boundary.

E—0 to 2 inches; dark grayish brown (10YR 4/2) loamy sand (volcanic ash and pumice), light brownish gray

(10YR 6/2) dry; single grain; loose; weakly smeary; many very fine and fine and common medium roots; strongly acid; abrupt wavy boundary.

Bhs—2 to 4 inches; dark reddish brown (5YR 3/2) loam (volcanic ash and pumice), dark reddish brown (5YR 3/3) dry; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; moderately smeary; common very fine, fine, medium, and coarse roots; about 5 percent pebbles; strongly acid; clear irregular boundary.

Bs—4 to 7 inches; dark reddish brown (5YR 3/4) loam, strong brown (7.5YR 5/6) dry; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; moderately smeary; common very fine, fine, medium, and coarse roots; about 10 percent pebbles; strongly acid; clear irregular boundary.

BCs—7 to 23 inches; dark yellowish brown (10YR 4/4) very gravelly loam, light yellowish brown (10YR 6/4) dry; moderate coarse subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; about 30 percent pebbles and 5 percent cobbles; moderately acid; clear smooth boundary.

2C—23 to 38 inches; yellowish brown (10YR 5/4) very gravelly loam, very pale brown (10YR 7/4) dry; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; about 40 percent pebbles and 10 percent cobbles; moderately acid; abrupt smooth boundary.

2R—38 inches; fractured andesite.

The depth to lithic contact is 20 to 40 inches. In the control section the content of rock fragments, including hard cinders, ranges from 35 to 60 percent.

The E horizon has hue of 10YR or 7.5YR, value of 4 to 6 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry. It has 0 to 15 percent hard cinders and pebbles.

The Bhs horizon has hue of 5YR or 7.5YR, value of 3 or 4 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist and dry. It is sandy loam, loam, gravelly sandy loam, or gravelly loam (volcanic ash and pumice). It has 0 to 30 percent pebbles and hard cinders. Reaction is very strongly acid or strongly acid.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4 when moist, and chroma of 4 to 6 when moist. It is sandy loam, loam, or gravelly loam. It has 10 to 35 percent pebbles and hard cinders. Reaction is very strongly acid to moderately acid.

The BCs horizon is very gravelly sandy loam or very gravelly loam. It has 30 to 50 percent pebbles and 5 to 10 percent cobbles.

The 2C horizon has hue of 2.5Y or 10YR, value of 4 or 5 when moist and 6 to 8 when dry, and chroma of 2 to 4 when moist and dry. It is very gravelly loam or very gravelly silt loam. It has 40 to 50 percent pebbles and 5 to 10 percent cobbles.

Nargar Series

The Nargar series consists of very deep, well drained soils formed in a mixture of volcanic ash and sandy alluvium over glacial outwash. These soils are on escarpments. Slopes are 0 to 70 percent. Elevation is 700 to 1,200 feet. The average annual precipitation is 50 to 75 inches, and the mean annual temperature is about 47 degrees F. The frost-free period is 150 to 170 days.

These soils are sandy, mixed, mesic Typic Haplothods.

Typical pedon of Nargar fine sandy loam, 0 to 15 percent slopes, in King County, about 2 miles west of the Tolt-Seattle Reservoir Dam, 1,700 feet west and 1,400 feet south of the northeast corner of sec. 35, T. 26 N., R. 8 E.

Oi—1 inch to 0; decomposed organic mat.

E—0 to 2 inches; dark brown (7.5YR 4/2) fine sandy loam, pinkish gray (7.5YR 6/2) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine roots; many very fine irregular pores; strongly acid; abrupt wavy boundary.

Bs1—2 to 11 inches; strong brown (7.5YR 4/6) fine sandy loam, strong brown (7.5YR 5/6) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine, fine, and medium roots; many very fine irregular pores; strongly acid; abrupt smooth boundary.

Bs2—11 to 24 inches; yellowish brown (10YR 5/6) fine sandy loam, brownish yellow (10YR 6/6) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and medium and few coarse roots; many fine irregular pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

2C—24 to 60 inches; olive brown (2.5Y 4/4) sand, light olive brown (2.5Y 5/4) dry; single grain; loose; many fine irregular pores; about 10 percent pebbles; slightly acid.

The thickness of the solum is 20 to 40 inches. The content of rock fragments ranges from 0 to 10 percent in the upper part of the particle-size control section and from 5 to 15 percent in the lower part.

The E horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry. Some pedons have an A horizon. This horizon has hue and chroma similar to those of the E horizon, but it has value of 2 or 3 when moist and 4 or 5 when dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is fine sandy loam or sandy loam.

The 2C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 2 to 4 when moist and dry. It is dominantly fine sand, sand, or gravelly sand. In some pedons, however, it is gravelly sand or very gravelly sand below a depth of 40 inches.

National Series

The National series consists of very deep, well drained soils formed in a mixture of volcanic ash and pumice over alluvium. These soils are on terraces. Slopes are 0 to 8 percent. Elevation is 1,200 to 1,800 feet. The average annual precipitation is 75 to 85 inches, and the mean annual air temperature is about 46 degrees F. The frost-free period is 155 to 175 days.

These soils are cindery over medial, mesic Umbric Vitrandepts.

Typical pedon of National cindery sandy loam, 0 to 8 percent slopes, in Pierce County, about 2.5 miles east of Ashford, 1,800 feet north and 100 feet east of the southwest corner of sec. 30, T. 15 N., R. 7 E.

Oa—2 inches to 0; undecomposed forest litter.

A—0 to 10 inches; very dark grayish brown (10YR 3/2) cindery sandy loam, dark brown (10YR 4/3) dry; weak very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium and coarse roots; many fine irregular pores; about 30 percent pumice 2 to 5 millimeters in diameter; moderately acid; clear smooth boundary.

Bw1—10 to 21 inches; dark brown (10YR 4/3) very cindery loamy sand, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium and few coarse roots; many fine irregular pores; about 40 percent pumice 2 to 5 millimeters in diameter and 2 percent pebbles; moderately acid; gradual wavy boundary.

Bw2—21 to 28 inches; dark yellowish brown (10YR 4/6) very cindery loamy sand, brownish yellow (10YR 6/6) dry; weak medium subangular blocky structure;

soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many fine irregular pores; about 50 percent pumice 2 to 5 millimeters in diameter and 2 percent pebbles; moderately acid; clear smooth boundary.

2Bw3—28 to 46 inches; dark yellowish brown (10YR 4/4) loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; common very fine tubular pores; about 5 percent pebbles; moderately acid; clear smooth boundary.

2C—46 to 60 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine roots; common very fine tubular pores; about 10 percent pebbles; moderately acid.

The umbric epipedon is 10 to 24 inches thick. Depth to the 2B horizon is 20 to 30 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 3 to 6 when moist and dry. It is very cindery sandy loam or very cindery loamy sand.

The 2Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 3 to 6 when moist and dry. It is loam or sandy loam.

The 2C horizon is silt loam or loam.

Neilton Series

The Neilton series consists of very deep, excessively drained soils formed in glacial outwash. These soils are on terraces. Slopes are 2 to 15 percent. Elevation is 400 to 500 feet. The average annual precipitation is 40 to 60 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 170 to 190 days.

These soils are sandy-skeletal, mixed, mesic Dystric Xerorthents.

Typical pedon of Neilton gravelly loamy sand, 2 to 15 percent slopes, in King County, about 1.5 miles southeast of North Bend, 1,500 feet south and 1,800 feet west of the northeast corner of sec. 15, T. 23 N., R. 8 E.

Oi—2 inches to 0; undecomposed needles, leaves, and twigs.

A—0 to 2 inches; very dark brown (10YR 2/2) gravelly loamy sand, dark brown (10YR 3/3) dry; weak

medium crumb structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many fine irregular pores; about 15 percent pebbles; strongly acid; clear smooth boundary.

Bs1—2 to 9 inches; dark yellowish brown (10YR 3/6) gravelly loamy sand, brownish yellow (10YR 6/6) dry; weak fine subangular blocky structure parting to single grain; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many fine irregular pores; about 15 percent pebbles; moderately acid; clear smooth boundary.

Bs2—9 to 16 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure parting to single grain; loose; many very fine, fine, medium, and coarse roots; many fine irregular pores; about 15 percent pebbles; moderately acid; clear smooth boundary.

BC—16 to 21 inches; dark brown (10YR 3/3) extremely gravelly sand, pale brown (10YR 6/3) dry; single grain; loose; many very fine and common fine roots; many fine irregular pores; about 60 percent pebbles; moderately acid; clear smooth boundary.

C—21 to 60 inches; very gravelly sand that is dominantly dark brown (10YR 4/3) but is variegated, pale brown (10YR 6/3) dry; single grain; loose; common very fine roots; many fine irregular pores; about 55 percent pebbles; moderately acid.

The thickness of the solum is 15 to 25 inches. The content of rock fragments in the control section is 40 to 60 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is dominantly gravelly loamy sand or gravelly sand. In some pedons, however, it is loamy sand or sand.

The BC and C horizons have hue of 10YR or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry. They are very gravelly or extremely gravelly sand.

Nimue Series

The Nimue series consists of very deep, well drained soils formed in a thin mantle of volcanic ash and pumice over residuum and colluvium derived from extrusive igneous rocks or from breccia and tuff. These soils are on rounded ridgetops and mountain back slopes. Slopes are 6 to 90 percent. Elevation is 3,400 to

5,000 feet. The average annual precipitation is 70 to 120 inches, and the mean annual air temperature is about 40 degrees F. The frost-free period is 110 to 130 days.

These soils are loamy-skeletal, mixed Haplic Cryohumods.

Typical pedon of Nimue loamy sand, 6 to 30 percent slopes, in the Government Meadows area in King County, 2,600 feet north and 700 feet west of the southeast corner of sec. 33, T. 19 N., R. 6 E.

Oi—3 to 2.5 inches; needles, leaves, and twigs; abrupt smooth boundary.

Oa—2.5 inches to 0; black (5YR 2.5/1), decomposed forest litter; many very fine roots; abrupt wavy boundary.

E—0 to 2 inches; gray (10YR 5/1) loamy sand (volcanic ash and pumice), light gray (10YR 7/1) dry; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; about 5 percent pebbles; very strongly acid; abrupt wavy boundary.

Bhs—2 to 5 inches; variegated dark reddish brown (5YR 3/2, 3/4) and yellowish red (5YR 5/6) loamy sand (volcanic ash and pumice), strong brown (7.5YR 4/6) dry; moderate medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many fine and medium and common coarse roots; about 10 percent pebbles; very strongly acid; abrupt irregular boundary.

Bs—5 to 10 inches; reddish brown (5YR 4/4) and strong brown (7.5YR 5/6) sandy loam (65 percent sand-sized volcanic ash), light brown (7.5YR 6/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine and few medium roots; about 12 percent pebbles; strongly acid; clear irregular boundary.

2BC—10 to 24 inches; brown (7.5YR 4/4) very gravelly loam, light yellowish brown (10YR 6/4) dry; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; moderately smeary; common fine and medium and few coarse roots; about 40 percent angular pebbles and 5 percent angular cobbles; moderately acid; gradual irregular boundary.

2C1—24 to 43 inches; dark yellowish brown (10YR 4/6) extremely gravelly silt loam, pale yellow (2.5Y 7/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; about 60 percent angular pebbles and 10 percent angular cobbles; moderately acid; diffuse smooth boundary.

2C2—43 to 60 inches; olive brown (2.5Y 4/4) extremely gravelly silt loam, light brownish gray (2.5Y 6/2) dry; weak fine subangular blocky structure; slightly hard, firm, sticky and plastic; about 65 percent angular pebbles and 10 percent angular cobbles; moderately acid.

The upper 6 to 12 inches of the solum ranges from 60 to 90 percent volcanic ash and pumice. The particle-size control section ranges from 40 to 70 percent rock fragments.

The E horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 3 to 7 when moist and 6 to 8 when dry and chroma of 0 to 2 when moist and dry.

The Bhs horizon is 2 to 5 inches thick. It has hue of 5YR or 7.5YR, value of 3 to 5 when moist, and chroma of 2 to 6 when moist and dry. It is sandy loam, fine sandy loam, or loamy sand (volcanic ash) in the fine-earth fraction. It has 0 to 30 percent coarse fragments. Reaction is very strongly acid to moderately acid.

The Bs horizon is loam, sandy loam, silt loam, or loamy sand (volcanic ash) in the fine-earth fraction. It has 0 to 35 percent gravel. Reaction is strongly acid or moderately acid.

The 2BC horizon has hue of 7.5YR or 10YR, value of 3 to 5 when moist, and chroma of 4 to 6 when moist and dry. It is sandy loam, fine sandy loam, or loam in the fine-earth fraction. It has 35 to 70 percent coarse fragments. Reaction is slightly acid to strongly acid.

The 2C horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist, and chroma of 2 to 6 when moist and dry. It is extremely gravelly sandy loam, extremely gravelly loam, extremely gravelly silt loam, extremely stony sandy loam, or very cobbly fine sandy loam in the basalt and andesite substratum phases.

Nooksack Series

The Nooksack series consists of very deep, moderately well drained soils formed in alluvium. These soils are on flood plains and river terraces. Slopes are 0 to 2 percent. Elevation is 30 to 500 feet. The average annual precipitation is 35 to 55 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 180 to 200 days.

These soils are coarse-silty, mixed, mesic Fluventic Haploxerolls.

Typical pedon of Nooksack silt loam, 0 to 2 percent slopes, in King County, about 1.5 miles northwest of Fall City, 2,140 feet north and 1,800 feet east of the southwest corner of sec. 4, T. 24 N., R. 7 E.

Ap1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; few fine

faint dark yellowish brown (10YR 4/4) mottles; weak thin platy structure; slightly hard, very friable; many roots; slightly acid; abrupt smooth boundary.

Ap2—2 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak coarse prismatic structure; slightly hard, very friable; common roots; slightly acid; abrupt smooth boundary.

Bw—11 to 29 inches; dark grayish brown (2.5Y 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common roots; moderately acid; clear smooth boundary.

C1—29 to 42 inches; dark grayish brown (10YR 4/2) and grayish brown (2.5Y 5/2) silt loam that has thin lenses of very fine sandy loam; light brownish gray (2.5Y 6/2) dry; massive; slightly hard, very friable, slightly sticky and slightly plastic; common roots; slightly acid; clear smooth boundary.

C2—42 to 60 inches; grayish brown (2.5Y 5/2) silt loam, light brownish gray (2.5Y 6/2) dry; massive; hard, friable, sticky and plastic; common roots; moderately acid.

Reaction is slightly acid or moderately acid throughout the profile.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and chroma of 2 or 3 when moist and dry. The Bw horizon has value of 4 or 5 when moist and 5 or 6 when dry and chroma of 2 to 4 when moist and dry. The C horizon has value of 4 or 5 when moist and 5 or 6 when dry and chroma of 2 to 4 when moist and dry. In some pedons it is mottled below a depth of 36 inches.

Norma Series

The Norma series consists of very deep, poorly drained soils formed in alluvium. These soils are in depressions on glacial till plains. Slopes are 0 to 3 percent. Elevation is 100 to 800 feet. The average annual precipitation is 35 to 60 inches, and the mean annual air temperature is 50 degrees F. The frost-free period is 170 to 190 days.

These soils are coarse-loamy, mixed, nonacid, mesic Mollic Haplaquepts.

Typical pedon of Norma loam, 0 to 3 percent slopes, in King County, about 3 miles northwest of the Tolt-Seattle Reservoir Dam, 800 feet east and 1,200 feet south of the northwest corner of sec. 22, T. 26 N., R. 8 E.

A—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine

granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine and common medium roots; many very fine irregular pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

Bg1—9 to 17 inches; dark grayish brown (10YR 4/2) and dark brown (10YR 4/3) gravelly loam, light brownish gray (10YR 6/2) and pale brown (10YR 6/3) dry; many medium prominent strong brown (7.5YR 4/6) mottles, strong brown (7.5YR 5/6) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine irregular pores; about 30 percent pebbles; slightly acid; gradual wavy boundary.

Bg2—17 to 33 inches; dark grayish brown (10YR 4/2) gravelly loam, light brownish gray (10YR 6/2) dry; common medium distinct dark yellowish brown (10YR 4/6) mottles, yellowish brown (10YR 5/6) dry; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; about 30 percent pebbles; slightly acid; clear smooth boundary.

Cg—33 to 60 inches; dark grayish brown (2.5Y 4/2) very gravelly sandy loam, light gray (5Y 7/2) dry; common fine prominent mottles, strong brown (7.5YR 4/6) moist and dry; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine irregular pores; about 50 percent pebbles; slightly acid.

In the particle-size control section, the content of clay is 5 to 15 percent and the content of rock fragments ranges from 10 to 30 percent. Individual horizons below a depth of 40 inches may have 35 to 50 percent pebbles.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and chroma of 1 or 2.

The Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 1 to 3 when moist and dry. It is loam, sandy loam, gravelly loam, or gravelly sandy loam.

The Cg horizon has hue of 2.5Y or 5Y, value of 6 or 7 when dry, and chroma of 1 or 2 when moist and dry. It is gravelly loam, gravelly sandy loam, very gravelly loam, or very gravelly sandy loam.

Oakes Series

The Oakes series consists of deep and very deep, well drained soils formed in a mixture of volcanic ash and colluvium and slope alluvium derived from glacial

drift or in block-and-ash flow deposited over compact lahar. These soils are on mountain back slopes and toe slopes. Slopes are 6 to 65 percent. Elevation is 1,400 to 2,800 feet. The average annual precipitation is 65 to 75 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 120 to 160 days.

These soils are loamy-skeletal, mixed, frigid Typic Haplorthods.

Typical pedon of Oakes gravelly loam, 6 to 30 percent slopes, in King County, about 4 miles west of Cedar Falls, 100 feet south and 1,400 feet west of the northeast corner of sec. 35, T. 23 N., R. 7 E.

Oi—5 to 2 inches; undecomposed needles, twigs, and leaves.

Oa—2 inches to 0; black (10YR 2/1), decomposed organic mat.

A—0 to 2 inches; very dark brown (10YR 2/2) loam, brown (10YR 4/3) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium roots; many very fine irregular pores; about 10 percent pebbles; strongly acid; abrupt wavy boundary.

Bs1—2 to 8 inches; dark reddish brown (5YR 3/4) gravelly loam, yellowish red (5YR 4/6) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine, medium, and coarse roots; many very fine irregular pores; about 15 percent pebbles and 5 percent cobbles; moderately acid; abrupt wavy boundary.

Bs2—8 to 22 inches; dark brown (7.5YR 3/4) very gravelly loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine, medium, and coarse roots; many very fine irregular pores; about 40 percent pebbles; moderately acid; clear smooth boundary.

Bs3—22 to 38 inches; dark yellowish brown (10YR 4/4) very gravelly loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; many very fine irregular pores; about 50 percent pebbles; moderately acid; abrupt smooth boundary.

C—38 to 60 inches; light olive brown (2.5Y 5/4) very gravelly sandy loam, light brownish gray (2.5Y 6/2) dry; massive; hard, firm, slightly sticky and slightly plastic; weakly smeary; about 55 percent pebbles; moderately acid.

The content of rock fragments in the particle-size control section is 35 to 55 percent.

The A horizon has value of 4 or 5 when dry and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 4 to 6 when moist and dry. It is dominantly very gravelly silt loam or very gravelly loam. In some pedons, however, the Bs1 horizon is gravelly loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6 when moist and 6 to 8 when dry, and chroma of 2 to 6 when moist and dry. It is very gravelly loam or very gravelly sandy loam.

Ogarty Series

The Ogarty series consists of well drained soils formed in a mixture of volcanic ash and colluvium and residuum derived from andesite and breccia. These soils are moderately deep to bedrock. They are on back slopes in the foothills. Slopes are 8 to 90 percent. Elevation is 500 to 1,800 feet. The average annual precipitation is 50 to 70 inches, and the mean annual air temperature is about 46 degrees F. The frost-free period is 150 to 170 days.

These soils are loamy-skeletal, mixed, mesic Typic Haplorthods.

Typical pedon of Ogarty gravelly loam, 30 to 65 percent slopes, in Pierce County, about 5 miles south of Enumclaw, 1,800 feet south and 1,000 feet west of the northeast corner of sec. 13, T. 19 N., R. 6 E.

Oi—1.5 inches to 0.5 inch; undecomposed twigs, leaves, and needles.

Oa—0.5 inch to 0; decomposed organic mat.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine and common medium and coarse roots; many very fine irregular pores; about 25 percent pebbles and 5 percent cobbles; moderately acid; clear wavy boundary.

Bs1—4 to 15 inches; dark brown (10YR 4/3) very gravelly fine sandy loam, pale brown (10YR 6/3) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine, fine, and medium and few coarse roots; common very fine tubular pores; about 10 percent cobbles and 45 percent pebbles; moderately acid; gradual wavy boundary.

Bs2—15 to 23 inches; dark yellowish brown (10YR 4/4) extremely gravelly fine sandy loam, light yellowish brown (10YR 6/4) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine, fine,

medium, and coarse roots; common very fine tubular pores; moderately acid; clear wavy boundary.

Bs3—23 to 28 inches; dark brown (7.5YR 4/4) extremely gravelly fine sandy loam, brownish yellow (10YR 6/6) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; few very fine, fine, and medium roots; few very fine tubular pores; about 45 percent pebbles and 25 percent cobbles; moderately acid; clear wavy boundary.

C—28 to 37 inches; brown (7.5YR 5/4) extremely gravelly fine sandy loam, very pale brown (10YR 7/4) dry; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; about 90 percent pebbles and 5 percent cobbles; moderately acid; clear wavy boundary.

2R—37 inches; fractured andesite.

The depth to bedrock is 20 to 40 inches. The content of rock fragments in the particle-size control section is 35 to 70 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 3 to 6 when moist and dry. It is very gravelly fine sandy loam, extremely gravelly loam, or extremely gravelly fine sandy loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 4 to 6 when moist and dry. It is extremely gravelly loam or extremely gravelly fine sandy loam.

Ohop Series

The Ohop series consists of very deep, well drained soils formed in recent volcanic mudflow. These soils are on river terraces and valley toe slopes. Slopes are 0 to 15 percent. Elevation is 1,400 to 2,400 feet. The average annual precipitation is 60 to 80 inches, and the mean annual air temperature is about 45 degrees F. The frost-free period is 120 to 145 days.

These soils are loamy-skeletal, mixed, frigid Aquic Dystrochrepts.

Typical pedon of Ohop very gravelly loam, 0 to 15 percent slopes, in Pierce County, about 200 feet south of St. Regis Paper Company King Creek Access Road, 2,300 feet south and 1,600 feet east of the northwest corner of sec. 17, T. 17 N., R. 6 E.

Oi—2 inches to 0; duff consisting of partially decomposed needles, twigs, and fine, matted roots.

- A—0 to 7 inches; dark grayish brown (10YR 4/2) very gravelly loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and nonplastic; many fine, very fine, and medium roots; about 40 percent pebbles; moderately acid; clear smooth boundary.
- Bw—7 to 16 inches; dark brown (10YR 3/3) very gravelly loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and nonplastic; many fine and very fine roots; about 40 percent pebbles and 10 percent cobbles; moderately acid; gradual smooth boundary.
- BC—16 to 28 inches; brown (10YR 4/3) extremely gravelly sandy loam, pale brown (10YR 6/3) dry; common medium distinct yellowish brown (10YR 5/6) mottles, brownish yellow (10YR 6/6) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few medium roots; 50 percent pebbles and 10 percent cobbles; moderately acid; gradual smooth boundary.
- C—28 to 60 inches; brown (10YR 4/3) extremely gravelly sandy loam, light gray (10YR 7/2) dry; massive; very hard, firm, nonsticky and nonplastic; 50 percent pebbles and 20 percent cobbles; strongly acid.

The particle-size control section is 10 to 25 percent volcanic ash and cinders, 35 to 50 percent pebbles, and 10 to 30 percent cobbles by volume. Reaction is strongly acid or moderately acid throughout the profile.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry and chroma of 2 to 4 when moist and dry.

The Bw horizon has value of 3 or 4 when moist and 6 or 7 when dry and chroma of 2 to 4 when moist and dry. It is very gravelly loam or very gravelly sandy loam.

The BC horizon has value of 3 or 4 when moist and 6 or 7 when dry and chroma of 2 to 4 when moist and dry. It is gravelly loam, extremely gravelly sandy loam, extremely gravelly loam, or very gravelly sandy loam.

The C horizon has value of 3 to 5 when moist and chroma of 2 to 4 when moist and dry. It is very gravelly, extremely gravelly, or very cobbly sandy loam.

Olomount Series

The Olomount series consists of well drained soils formed in a mixture of glacial till, volcanic ash, and colluvium derived from andesite. These soils are moderately deep to fractured bedrock. They are on mountain back slopes. Slopes are 8 to 90 percent. Elevation is 800 to 1,800 feet. The average annual

precipitation is 60 to 80 inches, and the mean annual air temperature is about 45 degrees F. The frost-free period is 130 to 150 days.

These soils are loamy-skeletal, mixed, frigid Typic Haplothods.

Typical pedon of Olomount gravelly loam, 8 to 30 percent slopes, in King County, about 8 miles east of Cherry Valley, 800 feet east and 200 feet south of the northwest corner of sec. 9, T. 26 N., R. 8 E.

Oi—2 inches to 1 inch; undecomposed needles, leaves, and twigs.

Oa—1 inch to 0; decomposed organic mat.

A—0 to 6 inches; dark brown (7.5YR 3/4) gravelly loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; many very fine, fine, and medium roots; many fine irregular pores; about 20 percent pebbles; moderately acid; clear smooth boundary.

Bs1—6 to 14 inches; strong brown (7.5YR 5/6) gravelly loam, reddish yellow (7.5YR 6/6) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium roots; many very fine irregular pores; about 25 percent pebbles; moderately acid; gradual smooth boundary.

Bs2—14 to 33 inches; brownish yellow (10YR 6/6) very gravelly loam, yellow (10YR 7/6) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine roots; many very fine irregular pores; about 45 percent pebbles; moderately acid; clear smooth boundary.

2R—33 inches; fractured andesite.

The depth to bedrock is 20 to 40 inches. The content of rock fragments in the control section is 35 to 55 percent.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist and dry. The Bs horizon has hue of 10YR or 7.5YR, value of 4 to 6 when moist and 5 to 7 when dry, and chroma of 4 to 6 when moist and dry. The Bs1 horizon is gravelly loam or very gravelly loam.

Oridia Series

The Oridia series consists of very deep, poorly drained soils formed in alluvium. These soils are on flood plains. Slopes are 0 to 2 percent. Elevation is 30 to 120 feet. The average annual precipitation is 35 to 55 inches, and the mean annual air temperature is about

50 degrees F. The frost-free period is 160 to 180 days.

These soils are coarse-silty, mixed, nonacid, mesic Aeric Fluvaquents.

Typical pedon of Oridia silt loam, 0 to 2 percent slopes, in King County, about 1.5 miles north of Carnation, 2,400 feet south and 1,500 feet east of the northwest corner of sec. 9, T. 25 N., R. 7 E.

Ap—0 to 11 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular and common fine and few coarse tubular pores; moderately acid; gradual smooth boundary.

Cg1—11 to 19 inches; brown (10YR 5/3) silt loam, yellowish brown (10YR 5/6) dry; few fine prominent yellowish brown (10YR 5/6) mottles, brownish yellow (10YR 6/6) dry, and few fine faint light brownish gray (10YR 6/2) mottles, light gray (10YR 7/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular and common fine and few coarse tubular pores; moderately acid; gradual smooth boundary.

Cg2—19 to 36 inches; grayish brown (10YR 5/2) very fine sandy loam, light gray (10YR 7/2) dry; few medium prominent yellowish brown (10YR 5/6) mottles, brownish yellow (10YR 6/6) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine irregular and common fine and few coarse tubular pores; slightly acid; gradual smooth boundary.

Cg3—36 to 47 inches; brown (10YR 5/3) very fine sandy loam, light gray (10YR 7/2) dry; few medium prominent yellowish brown (10YR 5/6) mottles, brownish yellow (10YR 6/6) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine irregular and common fine and few coarse tubular pores; few lenses of fine sandy loam about 0.5 inch thick; slightly acid; gradual smooth boundary.

Cg4—47 to 60 inches; gray (10YR 6/1) and light brownish gray (10YR 6/2) very fine sandy loam, white (10YR 8/1 and 8/2) dry; few medium prominent strong brown (7.5YR 5/8) mottles, reddish yellow (7.5YR 6/8) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and common fine irregular pores; neutral.

The content of clay in the control section is 10 to 18 percent. The distribution of organic material in these soils varies with increasing depth.

The Ap horizon has value of 4 or 5 when moist and 6 or 7 when dry and chroma of 2 or 3 when moist and dry. The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6 when moist and 5 to 8 when dry, and chroma of 1 to 6 when moist and dry. It is silt loam or very fine sandy loam.

Orthents

Orthents consist of moderately deep to very deep, well drained soils formed in colluvium derived from granite. They are on avalanche chutes and back slopes in the mountains. Slopes are 30 to 100 percent. Elevation is 1,500 to 5,000 feet. The average annual precipitation is 80 to 120 inches, and the mean annual air temperature is about 39 degrees F. The frost-free period is 90 to 140 days.

Typical pedon of Orthents, in an area of Orthents, avalanche chutes-Humods complex, 30 to 100 percent slopes, in King County, about 8 miles east of Skykomish; 2,500 feet east and 1,100 feet south of the northwest corner of sec. 30, T. 26 N., R. 13 E.

A—0 to 2 inches; very dark brown (10YR 2/2) gravelly sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots; many very fine irregular pores; about 20 percent pebbles; strongly acid; abrupt smooth boundary.

Bw—2 to 24 inches; dark yellowish brown (10YR 3/4) very cobbly loamy sand, light yellowish brown (10YR 6/4) dry; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; about 20 percent cobbles and 40 percent pebbles; strongly acid; clear wavy boundary.

C—24 to 30 inches; dark yellowish brown (10YR 4/4) extremely stony loamy sand, light yellowish brown (10YR 6/4) dry; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine irregular pores; about 40 percent stones, 20 percent cobbles, and 20 percent pebbles; strongly acid; abrupt smooth boundary.

2R—30 inches; weathered granite.

The depth to bedrock is 20 to 80 inches. The content of rock fragments in the control section ranges from 50 to 90 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 1 or 2 when moist and dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of

3 or 4 when moist and dry. It is very gravelly sandy loam or very cobbly loamy sand.

The C horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is extremely stony loamy sand or very gravelly sandy loam.

Ovall Series

The Ovall series consists of well drained soils formed in glacial drift mixed with residuum and colluvium derived from andesite. These soils are moderately deep to fractured bedrock. They are on back slopes in the foothills. Slopes are 15 to 65 percent. Elevation is 500 to 1,500 feet. The average annual precipitation is 45 to 60 inches, and the mean annual air temperature is about 51 degrees F. The frost-free period is 140 to 160 days.

These soils are loamy-skeletal, mixed, mesic Typic Xerumbrepts.

Typical pedon of Ovall gravelly loam, 30 to 65 percent slopes, in Pierce County, about 4 miles east of Kapowsin, 100 feet south and 250 feet east of the northwest corner of sec. 11, T. 17 N., R. 5 E.

Oi&Oe—1 inch to 0; fresh and partially decomposed needles, leaves, and twigs.

A—0 to 3 inches; dark brown (10YR 4/3) gravelly loam, pale brown (10YR 6/3) dry; strong medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine, common medium, and few coarse roots; many very fine irregular pores; about 30 percent pebbles; moderately acid; abrupt smooth boundary.

Bw—3 to 15 inches; brown (10YR 5/3) very gravelly loam, pale brown (10YR 6/3) dry; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and common medium and coarse roots; many very fine irregular pores; about 40 percent pebbles and 15 percent cobbles; moderately acid; clear smooth boundary.

C—15 to 24 inches; brown (10YR 4/3) very gravelly sandy loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common medium and few coarse roots; many very fine irregular pores; about 45 percent pebbles and 15 percent cobbles; moderately acid; clear wavy boundary.

2R—24 inches; fractured andesite.

The depth to bedrock is 20 to 40 inches. The content of rock fragments in the particle-size control section is 35 to 60 percent by volume. The umbric epipedon is 10 to 20 inches thick.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 1 to 3 when moist and dry. The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry. It is very gravelly loam or very gravelly sandy loam. The C horizon has value of 3 or 4 when moist and 6 or 7 when dry and chroma of 2 to 4 when moist and dry.

Pastik Series

The Pastik series consists of very deep, moderately well drained soils formed in lake sediments and volcanic ash. These soils are on terraces and escarpments. Slopes are 0 to 30 percent. Elevation is 200 to 800 feet. The average annual precipitation is 45 to 60 inches, and the mean annual air temperature is about 46 degrees F. The frost-free period is 160 to 180 days.

These soils are coarse-silty, mixed, mesic Aquic Haplothods.

Typical pedon of Pastik silt loam, 0 to 30 percent slopes, in King County, about 2 miles southeast of Duvall, 2,100 feet east and 2,700 feet south of the northwest corner of sec. 30, T. 26 N., R. 7 E.

Oi—2 inches to 0; undecomposed organic mat; common fine and medium roots.

A—0 to 6 inches; dark brown (7.5YR 3/2) silt loam, brown (10YR 5/3) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common fine, medium, and coarse roots; many very fine irregular pores; NaF pH 9.8; strongly acid; clear smooth boundary.

E—6 to 12 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; many very fine irregular pores; NaF pH 10.5; strongly acid; abrupt smooth boundary.

Bs—12 to 19 inches; dark yellowish brown (10YR 4/4) very fine sandy loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium roots; NaF pH 12.0; strongly acid; clear wavy boundary.

BC—19 to 31 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; NaF pH 11.5; strongly acid; abrupt smooth boundary.

C1—31 to 35 inches; olive brown (2.5Y 4/4) silt loam,

pale yellow (2.5Y 7/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and few very fine tubular pores; NaF pH 10.0; strongly acid; clear smooth boundary.

C2—35 to 60 inches; grayish brown (2.5Y 5/2) silt loam, light gray (2.5Y 7/2) dry; few fine prominent mottles, strong brown (7.5YR 5/6) moist and dry; massive; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; few very fine irregular pores; NaF pH 9.8; strongly acid.

The thickness of the solum is 20 to 40 inches. The depth to mottles with chroma of 2 or less is more than 30 inches. The content of rock fragments in the control section is 0 to 5 percent.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 10YR or 7.5YR, value of 4 to 6 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is silt loam, very fine sandy loam, or silty clay loam.

The C horizon has hue of 2.5Y or 5Y, value of 4 to 6 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is silt loam, very fine sandy loam, or silty clay loam below a depth of 40 inches.

Persis Series

The Persis series consists of very deep, well drained soils formed in a mixture of volcanic ash and alluvium over deltaic deposits. These soils are on stream terraces. Slopes are 0 to 8 percent. Elevation is 1,000 to 1,600 feet. The average annual precipitation is 80 to 120 inches, and the mean annual air temperature is about 47 degrees F. The frost-free period is 160 to 180 days.

These soils are coarse-loamy over sandy or sandy-skeletal, mixed, mesic Humic Haploorthods.

Typical pedon of Persis sandy loam, 0 to 8 percent slopes, in King County, along a spur road of the Weyerhaeuser Road 30, about 600 feet east and 1,400 feet south of the northwest corner of sec. 16, T. 25 N., R. 9 E.

Oi—3.5 inches to 0.5 inch; moss, needles, and partially decomposed wood fragments.

Oa—0.5 inch to 0; decomposed forest litter.

E—0 to 1.5 inches; brown (7.5YR 4/2) sandy loam, pinkish gray (7.5YR 6/2) dry; moderate fine and very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common very fine, fine, and medium roots; many very fine tubular pores; about 2 percent

rounded pebbles; NaF pH 9.2; extremely acid; abrupt smooth boundary.

Bhs—1.5 to 4 inches; dark reddish brown (5YR 3/2) sandy loam, reddish brown (5YR 4/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium roots; many very fine tubular pores; about 2 percent rounded pebbles; NaF pH 11.5; extremely acid; clear irregular boundary.

Bs1—4 to 13 inches; dark reddish brown (5YR 3/4) loam, brown (7.5YR 5/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; common very fine tubular pores; about 2 percent rounded pebbles; NaF pH 12.0+; strongly acid; clear wavy boundary.

Bs2—13 to 15 inches; dark brown (7.5YR 4/4) loam, light brown (7.5YR 6/4) dry; weak fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; common very fine tubular pores; about 5 percent rounded pebbles; NaF pH 12.0+; strongly acid; clear wavy boundary.

Bs3—15 to 29 inches; strong brown (7.5YR 4/6) loam, reddish yellow (7.5YR 6/6) dry; weak fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; few very fine roots; common very fine tubular pores; about 5 percent rounded pebbles; NaF pH 12.0+; moderately acid; clear wavy boundary.

2C—29 to 60 inches; grayish brown (2.5Y 5/2) sand, light gray (2.5Y 7/2) dry; massive; slightly hard, firm, nonsticky and nonplastic; weakly compact in place; common very fine interstitial pores; about 5 percent rounded pebbles; NaF pH 11.5; moderately acid.

By volume, the content of rock fragments ranges from 0 to 15 percent in the upper part of the control section and from 0 to 25 percent in the lower part.

The E horizon has hue of 7.5YR or 10YR when moist and dry, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry.

The Bhs and Bs1 horizons have hue of 2.5YR or 5YR when moist and 5YR or 7.5YR when dry, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist and dry. They are fine sandy loam, sandy loam, or loam. Reaction is extremely acid or very strongly acid in the Bhs horizon and very strongly acid or strongly acid in the Bs1 horizon.

The Bs2 and Bs3 horizons have hue of 5YR or 7.5YR when moist and 7.5YR or 10YR when dry, value of 4 or 5 when moist and 6 or 7 when dry, and chroma

of 4 to 6 when moist and dry. They are fine sandy loam or loam. Reaction is strongly acid or moderately acid.

The 2C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 or 3 when moist and dry. It is loamy sand, sand, gravelly loamy sand, or gravelly sand. The content of rock fragments is 0 to 25 percent by volume.

Pheene Series

The Pheene series consists of well drained soils formed in volcanic ash and in colluvium derived from andesite or breccia and tuff. These soils are moderately deep to fractured bedrock. They are on mountain back slopes. Slopes are 8 to 90 percent. Elevation is 1,500 to 2,800 feet. The average annual precipitation is 55 to 85 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 160 to 180 days.

These soils are medial-skeletal, frigid Andic Haplumbrepts.

Typical pedon of Pheene gravelly loam, in an area of Pheene-Rock outcrop complex, 30 to 90 percent slopes, in Pierce County, about 5 miles east of Ohop; 1,800 feet south and 1,000 feet west of the northeast corner of sec. 30, T. 17 N., R. 6 E.

Oi—3 inches to 1 inch; undecomposed needles, leaves, and twigs.

Oa—1 inch to 0; decomposed organic mat.

A—0 to 11 inches; very dark brown (10YR 2/2) gravelly loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, medium, and coarse roots; many very fine irregular and tubular pores; about 25 percent pebbles and 5 percent cobbles; NaF pH 10.0; strongly acid; clear wavy boundary.

Bw1—11 to 21 inches; dark brown (10YR 4/3) very gravelly loam, pale brown (10YR 6/3) dry; weak very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium and coarse roots; common very fine irregular and tubular pores; about 40 percent pebbles and 10 percent cobbles; NaF pH 10.5; moderately acid; gradual wavy boundary.

Bw2—21 to 34 inches; dark yellowish brown (10YR 4/4) extremely gravelly loam, light yellowish brown (10YR 6/4) dry; weak very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; few very fine, fine, and medium roots; common very fine irregular and tubular pores; about 45 percent pebbles and 20

percent cobbles; NaF pH 11.0; moderately acid; abrupt irregular boundary.

R—34 inches; fractured andesite.

The depth to bedrock is 20 to 40 inches. The content of rock fragments in the particle-size control section ranges from 35 to 70 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry. The Bw horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is very gravelly or extremely gravelly loam.

Philippa Series

The Philippa series consists of moderately deep, moderately well drained soils formed in a mixture of volcanic ash, colluvium, and ablation till over dense glacial till. These soils are in cirques and on lateral moraines on mountains. Slopes are 0 to 65 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 90 to 140 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 150 to 170 days.

These soils are loamy-skeletal, mixed, frigid, ortstein Humic Haplorthods.

Typical pedon of Philippa sandy loam, 0 to 30 percent slopes, in King County, along a spur road of Forest Service Road 50, about 800 feet south of the Tolt-Seattle Water Supply Reservoir, 2,600 feet east and 1,500 feet south of the northwest corner of sec. 34, T. 26 N., R. 9 E.

Oi—2 inches to 0.5 inch; moss, twigs, and needles.

Oa—0.5 inch to 0; decomposed forest litter; abrupt smooth boundary.

A—0 to 3 inches; dark brown (7.5YR 3/2) sandy loam, brown (7.5YR 5/3) dry; weak very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium roots; many very fine interstitial pores; about 5 percent subangular pebbles; NaF pH 9.6; very strongly acid; abrupt smooth boundary.

E—3 to 4 inches; dark grayish brown (10YR 4/2) coarse sandy loam (volcanic ash), pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; many very fine interstitial pores; about 5 percent subangular pebbles; NaF pH 9.6; extremely acid; abrupt smooth boundary.

Bhs—4 to 9 inches; variegated 70 percent dark reddish brown (5YR 3/3) and 30 percent strong brown (7.5YR 4/6) gravelly silt loam, reddish brown (5YR 4/3) and reddish yellow (7.5YR 6/6) dry; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; moderately smeary; common fine and medium roots; common very fine interstitial pores; about 15 percent subangular pebbles; NaF pH 12.0+; very strongly acid; gradual wavy boundary.

Bs—9 to 18 inches; dark brown (7.5YR 4/4) gravelly silt loam, reddish yellow (7.5YR 6/6) dry; moderate fine and very fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; moderately smeary; common fine roots; common very fine interstitial pores; about 25 percent subangular pebbles; NaF pH 12.0+; very strongly acid; clear smooth boundary.

BCs—18 to 28 inches; dark yellowish brown (10YR 4/4) very gravelly sandy loam, yellowish brown (10YR 5/6) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately smeary; few very fine roots; common very fine interstitial pores; about 45 percent subangular pebbles and 10 percent cobbles; NaF pH 12.0+; very strongly acid; abrupt smooth boundary.

Bsm—28 to 60 inches; dark grayish brown (2.5Y 4/2) ortstein (cemented glacial till) that breaks to extremely gravelly loamy sand, light brownish gray (2.5Y 6/2) dry; common fine prominent dark reddish brown (5YR 3/3) and reddish brown (5YR 4/4) mottles; massive; extremely hard, extremely firm, nonsticky and nonplastic; about 60 percent subangular pebbles and 10 percent cobbles; NaF pH 12.0+; strongly acid.

The depth to ortstein is 20 to 40 inches. The content of rock fragments in the control section ranges from 35 to 50 percent by volume.

The A horizon has hue of 7.5YR or 10YR when moist and dry, value of 4 or 5 when dry, and chroma of 2 or 3 when moist and dry. Reaction is extremely acid or very strongly acid.

The E horizon has hue of 7.5YR or 10YR when moist and dry, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry. It is sandy loam or coarse sandy loam.

The Bhs horizon has hue of 7.5YR or 5YR when moist and dry, matrix value of 4 or 5 when dry, and matrix chroma of 2 or 3 when moist and dry. It is silt loam, loam, gravelly silt loam, or gravelly loam. The content of rock fragments is 10 to 20 percent by volume.

The Bs horizon has chroma of 4 to 6 when dry. It is gravelly loam, gravelly silt loam, or very gravelly loam. The content of rock fragments is 20 to 40 percent by volume. Reaction is very strongly acid or strongly acid.

The BCs horizon has value of 5 or 6 when dry and chroma of 4 to 6 when moist and dry. It is very gravelly loam, very gravelly sandy loam, extremely gravelly loam, or extremely gravelly sandy loam. The content of rock fragments is 50 to 70 percent by volume. Reaction is very strongly acid or strongly acid.

The Bsm horizon has value of 4 or 5 when moist and 6 or 7 when dry. It is ortstein made up of iron and organic material. It breaks to extremely gravelly loamy sand or extremely gravelly loamy coarse sand. The content of rock fragments is 60 to 80 percent by volume.

Pierking Series

The Pierking series consists of very deep, somewhat poorly drained soils formed in stream alluvium and mudflow deposits. These soils are on river terraces. Slopes are 0 to 5 percent. Elevation is 1,200 to 2,000 feet. The average annual precipitation is 60 to 80 inches, and the mean annual air temperature is about 46 degrees F. The frost-free period is 110 to 130 days.

These soils are loamy-skeletal, mixed, nonacid, frigid Typic Haplaquepts.

Typical pedon of Pierking gravelly sandy loam, 0 to 3 percent slopes, in Pierce County, about 100 feet north of St. Regis Paper Company Road 2, about 1,700 feet north and 2,500 feet east of the southwest corner of sec. 3, T. 16 N., R. 6 E.

Oe—4 to 2 inches; partially decomposed leaf litter and matted roots.

Oa—2 inches to 0; very dark brown (10YR 2/2), well decomposed organic material, very dark grayish brown (10YR 3/2) after rubbing.

A—0 to 3 inches; dark brown (7.5YR 3/2) loam, grayish brown (10YR 5/2) dry; strong medium granular structure; soft, friable, nonsticky and slightly plastic; many fine and very fine roots; strongly acid; abrupt wavy boundary.

Bg1—3 to 22 inches; dark brown (7.5YR 4/2) very gravelly sandy loam, light brownish gray (10YR 6/2) dry; many large prominent dark red (2.5YR 3/6) and reddish yellow (7.5YR 6/6) mottles, yellowish red (5YR 5/6) and light yellowish brown (10YR 6/4) dry; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; about 35 percent pebbles; moderately acid; clear smooth boundary.

Bg2—22 to 34 inches; dark gray (N 4/0) very gravelly sandy loam, pale red (2.5YR 6/2) dry; common

medium distinct dark brown (7.5YR 4/2) and yellowish red (5YR 3/6) mottles, brown (7.5YR 5/4) and brownish yellow (10YR 6/6) dry; massive; hard, friable, slightly sticky and slightly plastic; about 45 percent pebbles; moderately acid; clear smooth boundary.

Cg—34 to 60 inches; dark bluish gray (5B 4/1) very gravelly sandy loam, gray (N 5/0) dry; massive; hard, friable, slightly sticky and nonplastic; about 50 percent pebbles; slightly acid.

The thickness of the solum is 15 to 40 inches. The content of clay in the particle-size control section is 5 to 18 percent. The content of rock fragments is 35 to 55 percent by weighted average.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 1 or 2 when moist and dry. Reaction is strongly acid or moderately acid.

The Bg horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 3 to 5 when moist and 5 or 6 when dry and chroma of 0 to 2 when moist and dry. It has faint to prominent mottles with hue of 2.5YR, 5YR, or 7.5YR, value of 3 to 6, and chroma of 2 to 6 when moist and dry. This horizon is gravelly sandy loam or very gravelly sandy loam. Reaction is strongly acid or moderately acid.

The Cg horizon has hue of 10YR, 2.5Y, 5Y, 5B, or 5Bg or is neutral in hue. It has value of 3 to 5 when moist and 5 to 7 when dry and chroma of 0 to 2 when moist and dry. In some pedons it has faint or distinct mottles with hue of 5YR or 7.5YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 4 to 8 when moist and dry. This horizon is very gravelly sandy loam or very gravelly loamy sand. Reaction is strongly acid to slightly acid.

Pilchuck Series

The Pilchuck series consists of very deep, somewhat excessively drained soils formed in sandy alluvium. These soils are on flood plains. Slopes are 0 to 3 percent. Elevation is 200 to 800 feet. The average annual precipitation is 35 to 60 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 170 to 190 days.

These soils are mixed, mesic Dystric Xeropsamments.

Typical pedon of Pilchuck loamy fine sand, 0 to 3 percent slopes, in King County, about 11 miles east of Enumclaw, along the White River, 1,100 feet east and 1,200 feet south of the northwest corner of sec. 2, T. 19 N., R. 8 E.

Oi—0.5 inch to 0; undecomposed needles, leaves, and twigs.

C1—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; single grain; loose; few very fine, fine, and medium roots; many fine irregular pores; slightly acid; abrupt smooth boundary.

C2—9 to 12 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark gray (10YR 4/1) dry; single grain; loose; many very fine, fine, and medium and common coarse roots; many fine irregular pores; moderately acid; abrupt smooth boundary.

C3—12 to 26 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark gray (10YR 4/1) dry; single grain; loose; common very fine, fine, and medium roots; many fine irregular pores; slightly acid; clear smooth boundary.

C4—26 to 37 inches; very dark gray (10YR 3/1) fine sand, dark gray (10YR 4/1) dry; single grain; loose; common very fine and fine roots; many fine irregular pores; slightly acid; clear smooth boundary.

C5—37 to 55 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark gray (10YR 4/1) dry; single grain; loose; common very fine, fine, medium, and coarse roots; many fine irregular pores; slightly acid; clear smooth boundary.

C6—55 to 60 inches; black (10YR 2/1) very gravelly sand, very dark gray (10YR 3/1) dry; single grain; loose; many fine irregular pores; about 40 percent pebbles and 15 percent cobbles; slightly acid.

The content of rock fragments in the control section ranges from 0 to 15 percent. Individual horizons below a depth of 40 inches may have 15 to 60 percent rock fragments. The content of organic carbon decreases irregularly with increasing depth.

The C horizon has hue of 10YR or 2.5Y, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 1 to 3 when moist and dry. It is loamy fine sand or fine sand within a depth of 40 inches and loamy fine sand, fine sand, gravelly sand, or very gravelly sand below that depth.

Pitcher Series

The Pitcher series consists of very deep, well drained soils formed in volcanic ash over colluvium and residuum derived from extrusive igneous rocks or breccia and tuff. These soils are on mountain back slopes and toe slopes. Slopes are 8 to 65 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 55 to 80 inches, and the mean annual

air temperature is about 44 degrees F. The frost-free period is 135 to 155 days.

These soils are loamy-skeletal, mixed, frigid Typic Haplorthods.

Typical pedon of Pitcher sandy loam, 30 to 65 percent slopes, in King County, about 2 miles east of Crystal Village, 2,200 feet south and 300 feet east of the northwest corner of sec. 20, T. 19 N., R. 10 E.

Oi—1.5 inches to 1 inch; leaves, needles, and twigs; abrupt smooth boundary.

Oa—1 inch to 0; decomposed organic litter; abrupt smooth boundary.

A—0 to 8 inches; dark brown (10YR 4/3) sandy loam (volcanic ash and cinders), pale brown (10YR 6/3) dry; single grain; loose; weakly smeary; common very fine, fine, medium, and coarse roots; about 10 percent pebbles and 5 percent hard cinders; moderately acid; clear smooth boundary.

2Bs1—8 to 16 inches; dark brown (10YR 4/3) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; single grain; loose; weakly smeary; common very fine, fine, medium, and coarse roots; about 15 percent pebbles and 10 percent hard cinders; slightly acid; clear smooth boundary.

2Bs2—16 to 24 inches; brown (10YR 4/3) very gravelly loam, light yellowish brown (10YR 6/4) dry; dark brown (7.5YR 4/4), weathered, hard cinders and pebbles; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few medium roots; about 40 percent pebbles, 15 percent hard cinders, and 1 percent cobbles; slightly acid; clear smooth boundary.

2Bs3—24 to 29 inches; brown (10YR 4/3) very gravelly loam, light yellowish brown (10YR 6/4) dry; moderate fine subangular structure; soft, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and few fine roots; about 10 percent hard cinders, 45 percent pebbles, and 1 percent cobbles; moderately acid; gradual smooth boundary.

2BC1—29 to 38 inches; brown (10YR 4/3) very gravelly loam, very pale brown (10YR 7/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; about 50 percent pebbles and 5 percent cobbles; moderately acid; gradual smooth boundary.

2BC2—38 to 60 inches; yellowish brown (10YR 5/4) very gravelly loam, very pale brown (10YR 7/3) dry; moderate medium subangular structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine roots; about 50

percent pebbles and 5 percent cobbles; slightly acid.

The upper 7 to 14 inches of these soils is more than 60 percent volcanic ash and pumice. The particle-size control section ranges from 35 to 60 percent rock fragments by volume.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry. Reaction is strongly acid or moderately acid.

The 2Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist. It is sandy loam or loam in the fine-earth fraction. It has 0 to 20 percent hard cinders, 10 to 45 percent pebbles, and 0 to 15 percent cobbles. This horizon is weakly or moderately smeary throughout. Reaction is strongly acid to slightly acid.

The 2BC horizon has hue of 2.5Y, 10YR, or 7.5YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 3 to 6 when moist and dry. It is very gravelly sandy loam, very gravelly loam, extremely cobbly sandy loam, or extremely cobbly loam. It has 30 to 50 percent pebbles and 5 to 40 percent cobbles. Reaction is moderately acid or slightly acid.

Playco Series

The Playco series consists of very deep, well drained soils formed in volcanic ash and pumice mixed with colluvium derived from andesite, breccia, and tuff. These soils are on mountain back slopes. Slopes are 5 to 90 percent. Elevation is 2,500 to 3,600 feet. The average annual precipitation is 75 to 90 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 110 to 130 days.

These soils are loamy-skeletal, mixed Haplic Cryohumods.

Typical pedon of Playco loamy sand, 30 to 65 percent slopes, in Pierce County, about 8 miles east of Enumclaw, 1,400 feet west and 1,250 feet south of the northeast corner of sec. 20, T. 20 N., R. 8 E.

Oi—1 to 0.5 inch; loose forest litter, including needles, twigs, bark, and moss.

Oa—0.5 inch to 0; decomposed organic material.

E—0 to 3 inches; dark gray (10YR 4/1) loamy sand (volcanic ash and pumice), gray (7.5YR 5/1) dry; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; NaF pH less than 9.2; very strongly acid; abrupt smooth boundary.

Bhs1—3 to 6 inches; dark reddish brown (5YR 3/3) sandy loam (volcanic ash and pumice), dark brown (7.5YR 4/4) dry; weak medium subangular blocky

structure; slightly hard, friable, slightly sticky and slightly plastic; about 5 percent pebbles; many very fine, fine, medium, and coarse roots; NaF pH 12.0; very strongly acid; abrupt smooth boundary.

Bhs2—6 to 10 inches; dark brown (7.5YR 3/3) sandy loam (volcanic ash and pumice), yellowish brown (10YR 5/6) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine and many fine and medium roots; NaF pH 12.0; moderately acid; clear irregular boundary.

2Bs—10 to 21 inches; dark brown (7.5YR 4/4) very gravelly loam, yellowish brown (10YR 5/6) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine, medium, and coarse roots; about 30 percent hard angular pebbles and 10 percent cobbles; NaF pH 11.5; moderately acid; clear smooth boundary.

2BCs—21 to 36 inches; dark yellowish brown (10YR 4/4) extremely gravelly loam, very pale brown (10YR 7/4) dry; weak fine subangular blocky structure; very soft, very friable, slightly sticky and slightly plastic; moderately smeary; few very fine and fine roots; few very fine and common fine interstitial pores; about 55 percent angular hard pebbles and 10 percent cobbles; NaF pH 11.5; moderately acid; clear smooth boundary.

2C—36 to 60 inches; yellowish brown (10YR 5/4) very gravelly loam, very pale brown (10YR 7/4) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; moderately smeary; common fine continuous tubular pores; about 10 percent hard angular cobbles, 40 percent hard angular pebbles, and 5 percent stones; NaF pH 11.5; moderately acid.

The content of rock fragments, including hard cinders, in the control section is 35 to 70 percent by volume.

The E horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 4 to 7 when moist and 5 to 8 when dry and chroma of 0 to 2 when moist and dry. The content of rock fragments is 0 to 25 percent. Reaction is very strongly acid or strongly acid.

The Bhs horizon is 7 to 12 inches thick. It has hue of 5YR or 7.5YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 3 to 6 when moist and dry. It is loamy sand or sandy loam (volcanic ash and fine pumice). Reaction is very strongly acid to moderately acid.

The 2Bs and 2BCs horizons have hue of 5YR, 7.5YR, or 10YR, value of 3 or 4 when moist, and chroma of 3 to 6 when moist. They are very gravelly

loam, extremely gravelly sandy loam, very gravelly sandy loam, or extremely gravelly loam. Reaction is strongly acid to slightly acid.

The 2C horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist and 6 to 8 when dry, and chroma of 3 to 6 when moist and dry. It is very gravelly sandy loam, very gravelly loam, or extremely gravelly loam. It has 30 to 50 percent pebbles and 10 to 20 percent cobbles. Reaction is strongly acid to slightly acid.

Puget Series

The Puget series consists of very deep, poorly drained soils formed in alluvium. These soils are on flood plains. Slopes are 0 to 2 percent. Elevation is 25 to 500 feet. The average annual precipitation is 35 to 55 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 160 to 180 days.

These soils are fine-silty, mixed, nonacid, mesic Aeric Fluvaquents.

Typical pedon of Puget silty clay loam, 0 to 2 percent slopes, in King County, about 0.5 mile southwest of Carnation, 2,640 feet north and 600 feet east of the southwest corner of sec. 21, T. 25 N., R. 7 E.

A1—0 to 1 inch; very dark grayish brown (2.5Y 3/2) silt loam, moderate thin platy structure; hard, firm, slightly sticky and slightly plastic; many roots; moderately acid; abrupt smooth boundary.

A2—1 to 7 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light gray (2.5Y 7/2) dry; common fine prominent dark brown (7.5YR 4/4) mottles; moderate very coarse prismatic structure; hard, firm, sticky and plastic; many roots; moderately acid; clear smooth boundary.

Cg1—7 to 17 inches; grayish brown (2.5Y 5/2) silty clay loam, light gray (2.5Y 7/2) dry; common medium prominent strong brown (7.5YR 5/6, 5/8) mottles; moderate medium prismatic structure; hard, firm, sticky and plastic; many roots; slightly acid; clear smooth boundary.

Cg2—17 to 25 inches; grayish brown (2.5Y 5/2) silty clay loam, light olive gray (5Y 6/2) dry; many medium prominent yellowish red (5YR 5/8, 4/8) mottles; strong very coarse prismatic structure; very hard, firm, sticky and plastic; common roots; slightly acid; abrupt smooth boundary.

Cg3—25 to 31 inches; grayish brown (2.5Y 5/2) silty clay loam, light gray (5Y 7/2) dry; many medium prominent dark yellowish brown (10YR 3/6) and yellowish red (5YR 5/8, 4/6) mottles; moderate medium angular blocky structure; hard, firm, sticky and plastic; few roots; moderately acid; abrupt wavy boundary.

Cg4—31 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam, light gray (5Y 7/1) dry; common fine prominent strong brown (7.5YR 5/6) and yellowish red (5YR 4/8) mottles; strong very coarse prismatic structure; hard, firm, sticky and plastic; few roots; moderately acid; clear smooth boundary.

Cg5—40 to 45 inches; greenish gray (5GY 5/1) silty clay loam, light gray (5Y 7/1) and white (5Y 8/1) dry; common fine prominent strong brown (7.5YR 5/6) and brown (7.5YR 4/4) mottles; massive; hard, firm, sticky and plastic; moderately acid; clear smooth boundary.

Cg6—45 to 60 inches; gray (5Y 5/1) silty clay, light gray (5Y 7/1) dry; few fine prominent yellowish red (5YR 4/8, 5/8) and common medium distinct light olive brown (2.5Y 5/4) mottles; massive; very hard, firm, sticky and plastic; moderately acid.

The water table is at or near the surface from November through April unless the soils have been drained.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist and 4 to 7 when dry, and chroma of 1 or 2 when moist and dry. Reaction is moderately acid to neutral.

The part of the Cg horizon within a depth of 30 inches has hue of 10YR, 5YR, or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 when moist and 1 or 2 when dry. The part below a depth of 30 inches has hue of 10YR, 2.5Y, 5Y, or 5GY or is neutral in hue. It has value of 4 or 5 when moist and 6 or 7 when dry and chroma of 0 to 2 when moist and dry. The part of the Cg horizon within a depth of 40 inches is dominantly silt loam or silty clay loam, but in some pedons it has strata of sand or loamy sand less than 2 inches thick. The part below a depth of 40 inches is dominantly silt loam, silty clay loam, or silty clay, but in some pedons it has strata of sand or loamy sand. Reaction is slightly acid to very strongly acid throughout the Cg horizon.

Ragnar Series

The Ragnar series consists of very deep, well drained soils formed in glacial outwash. These soils are on terraces and escarpments. Slopes are 6 to 45 percent. Elevation is 500 to 1,000 feet. The average annual precipitation is 35 to 60 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 170 to 190 days.

These soils are coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplorthods.

Typical pedon of Ragnar loam, 15 to 30 percent slopes, in King County, about 1 mile east of Hobart,

1,300 feet south and 800 feet east of the northwest corner of sec. 5, T. 22 N., R. 7 E.

Oi—1 inch to 0; undecomposed needles, leaves, and twigs.

A—0 to 3 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; many fine irregular pores; about 5 percent pebbles; moderately acid; abrupt smooth boundary.

Bs1—3 to 13 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine irregular pores; about 5 percent pebbles; moderately acid; clear smooth boundary.

Bs2—13 to 24 inches; dark yellowish brown (10YR 4/4) sandy loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine roots; many very fine pores; about 5 percent pebbles; moderately acid; clear wavy boundary.

2C—24 to 60 inches; light olive brown (2.5Y 5/4) loamy sand, pale yellow (2.5Y 7/4) dry; single grain; loose; many fine irregular pores; moderately acid.

Depth to the 2C horizon ranges from 20 to 35 inches. The content of rock fragments in the particle-size control section is 0 to 10 percent by volume.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. The Bs1 horizon is loam or sandy loam.

The 2C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is loamy sand or sand.

Reggad Series

The Reggad series consists of very deep, excessively drained soils formed in a mixture of volcanic ash, organic material, and pumice over rock rubble. These soils are on mountain back slopes. Slopes are 30 to 90 percent. Elevation is 2,800 to 6,000 feet. The average annual precipitation is 70 to 130 inches, and the mean annual air temperature is about 41 degrees F. The frost-free period is 90 to 110 days.

These soils are dysic Typic Cryofolists.

Typical pedon of Reggad muck, in an area of

Reggad-Haywire complex, 45 to 90 percent slopes, in the Denny Creek area in King County, about 500 feet west of the I-90 freeway; 800 feet north and 500 feet west of the southeast corner of sec. 6, T. 22 N., R. 11 E.

- Oi—0 to 1 inch; loose leaves, twigs, and moss; extremely acid; abrupt smooth boundary.
- Oe—1 to 2 inches; dark brown (7.5YR 3/4) muck, dark brown (7.5YR 4/4) dry; massive; hard, friable, nonsticky and nonplastic; 90 percent fiber before rubbing and 50 percent after rubbing; many very fine and fine roots; extremely acid; abrupt smooth boundary.
- Oa1—2 to 8 inches; black (10YR 2/1) very cobbly muck, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; about 10 percent fiber before rubbing and 1 percent after rubbing; about 20 percent angular cobbles and 25 percent angular pebbles; very strongly acid; abrupt wavy boundary.
- Oa2—8 to 17 inches; very dark grayish brown (10YR 3/2) very cobbly muck, dark grayish brown (10YR 4/2) dry; weak very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; moderately smeary; few fine and medium roots; about 20 percent angular cobbles, 25 percent angular pebbles, and 25 percent pumice 2 to 5 millimeters in diameter; NaF pH 11.5; moderately acid; abrupt irregular boundary.
- 2C1—17 to 28 inches; dark yellowish brown (10YR 4/4) angular rock fragments, dark yellowish brown (10YR 3/4) dry; about 10 percent stones, 60 percent cobbles, and 20 percent pebbles; voids partially filled with coarse sand; few fine and medium roots; moderately acid; gradual irregular boundary.
- 2C2—28 to 60 inches; dark yellowish brown (10YR 4/4) angular rock fragments, dark yellowish brown (10YR 3/4) dry; about 10 percent stones, 60 percent cobbles, and 20 percent pebbles; voids partially filled with coarse sand; strongly acid.

The O horizon is dominantly sapric material. The Oi, Oe, and Oa1 horizons are extremely acid or very strongly acid, and the Oa2 horizon is strongly acid or moderately acid. The Oa2 horizon has hue of 7.5YR or 10YR and value of 2 or 3 when moist and 3 or 4 when dry. It has 20 to 40 percent volcanic ash and pumice.

The 2C horizon is sand or coarse sand in the fine-earth fraction. The fine earth is generally confined to the upper 20 inches of the horizon and does not exceed 15 percent of the total volume. Most interstices are not filled with fines. In some pedons this horizon has volcanic ash and pumice.

Reichel Series

The Reichel series consists of deep and very deep, well drained soils formed in a mixture of volcanic ash and colluvium and residuum derived from andesite or breccia and tuff. These soils are on glacially modified mountain back slopes and ridgetops. Slopes are 6 to 65 percent. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 70 to 90 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 140 to 150 days.

These soils are medial Andic Cryumbrepts.

Typical pedon of Reichel silt loam, 6 to 30 percent slopes, in Pierce County, about 4.5 miles southeast of Ohop, 500 feet south and 1,000 feet east of the northwest corner of sec. 6, T. 16 N., R. 6 E.

- Oi—3 inches to 1 inch; undecomposed needles, leaves, and twigs.
- Oa—1 inch to 0; very dark grayish brown (10YR 3/2), decomposed organic mat; many very fine, fine, and medium roots.
- A1—0 to 10 inches; very dark brown (10YR 2/2) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; about 10 percent pebbles; NaF pH 11.0; very strongly acid; clear smooth boundary.
- A2—10 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, yellowish brown (10YR 5/4) dry; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common very fine, fine, and medium roots; many fine irregular pores; about 10 percent pebbles; NaF pH 11.5; strongly acid; abrupt irregular boundary.
- Bw—18 to 28 inches; dark yellowish brown (10YR 4/4) gravelly loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many fine irregular pores; about 25 percent pebbles; NaF pH 10.0; strongly acid; clear irregular boundary.
- C—28 to 47 inches; dark brown (10YR 4/3) very gravelly clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; many fine irregular pores; about 30 percent pebbles and 10 percent cobbles; NaF pH 10.0; strongly acid; abrupt irregular boundary.
- R—47 inches; andesite.

The depth to bedrock is 40 to 80 inches. The content of rock fragments in the particle-size control section ranges from 15 to 30 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist and dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is gravelly loam or gravelly clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is very gravelly loam or very gravelly clay loam.

Rober Series

The Rober series consists of very deep, moderately well drained soils formed in volcanic ash and glaciolacustrine sediments. These soils are on mountain back slopes and plateaus. Slopes are 0 to 65 percent. Elevation is 1,000 to 1,800 feet. The average annual precipitation is 60 to 80 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 130 to 150 days.

These soils are coarse-silty, mixed, frigid Aquic Haploorthods.

Typical pedon of Rober loam, 0 to 30 percent slopes, in King County, about 1 mile northwest of Humphrey, 1,900 feet south and 1,400 feet west of the northeast corner of sec. 12, T. 20 N., R. 8 E.

Oi—5 to 2 inches; undecomposed needles, leaves, and twigs.

Oa—2 inches to 0; decomposed organic mat; common fine and medium roots.

A—0 to 2 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 5/2) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common fine, medium, and coarse roots; many very fine irregular pores; about 2 percent pebbles and 10 percent cinders 2 to 5 millimeters in diameter; NaF pH 11.0; strongly acid; clear smooth boundary.

Bs1—2 to 13 inches; dark brown (7.5YR 4/4) loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; many very fine irregular pores; about 2 percent pebbles and 10 percent cinders 2 to 5 millimeters in diameter; NaF pH 11.0; strongly acid; abrupt smooth boundary.

2Bs2—13 to 24 inches; dark yellowish brown (10YR 4/4) loam, light yellowish brown (10YR 6/4) dry;

moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium roots; common very fine tubular pores; about 5 percent pebbles; NaF pH 11.5; moderately acid; clear smooth boundary.

2Bs3—24 to 30 inches; dark brown (7.5YR 4/4) loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; common very fine tubular pores; about 10 percent pebbles; NaF pH 11.5; moderately acid; abrupt smooth boundary.

2C—30 to 60 inches; grayish brown (2.5Y 5/2) silt loam, light gray (2.5Y 7/2) dry; few fine prominent mottles, strong brown (7.5YR 5/6) moist and dry; massive; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine roots; few very fine irregular pores; about 5 percent pebbles; NaF pH 11.0; moderately acid.

The thickness of the solum is 20 to 40 inches. The depth to mottles with chroma of 2 or less is 30 inches or more. The content of rock fragments in the control section ranges from 0 to 5 percent.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is loam or silt loam.

The 2C horizon has hue of 2.5Y or 5Y, value of 4 to 6 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is stratified silt loam or silty clay loam below a depth of 40 inches.

Rugles Series

The Rugles series consists of very deep, well drained soils formed in a mixture of lacustrine deposits and tephra. These soils are on dissected terraces. Slopes are 0 to 15 percent. Elevation is 1,700 to 2,400 feet. The average annual precipitation is 50 to 70 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 150 to 170 days.

These soils are medial, frigid Entic Dystrandepts.

Typical pedon of Rugles silt loam, 0 to 15 percent slopes, in Pierce County, 150 feet north and 1,320 feet east of the intersection of St. Regis Paper Company Roads 0-501 and 0-500, in sec. 24, T. 17 N., R. 5 E.

Oe—2 inches to 0; duff consisting of partially decomposed twigs and needles; abrupt smooth boundary.

- A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, dark yellowish brown (10YR 4/4) dry; strong medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many fine and very fine and common coarse roots; strongly acid; abrupt wavy boundary.
- AB—4 to 11 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (2.5Y 6/4) dry; moderate medium subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and slightly plastic; weakly smeary; many fine and very fine roots; strongly acid; abrupt wavy boundary.
- Bw1—11 to 16 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate coarse subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and slightly plastic; moderately smeary; many fine and very fine roots; strongly acid; clear wavy boundary.
- Bw2—16 to 32 inches; grayish brown (10YR 5/2) silt loam, white (2.5Y 8/2) dry; moderate coarse subangular blocky structure; hard, friable, slightly sticky and plastic; weakly smeary; common fine and very fine roots; moderately acid; gradual smooth boundary.
- Bw3—32 to 45 inches; grayish brown (10YR 5/2) silt loam, white (2.5Y 8/2) dry; moderate coarse subangular blocky structure; hard, friable, slightly sticky and plastic; moderately smeary; common fine and very fine roots; moderately acid; gradual smooth boundary.
- BC—45 to 57 inches; grayish brown (10YR 5/2) silt loam, white (2.5Y 8/2) dry; moderate very coarse subangular blocky structure; hard, friable, slightly sticky and plastic; few thin clay films coating mineral grains; moderately acid; abrupt smooth boundary.
- C—57 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, white (2.5Y 8/2) dry; common fine distinct strong brown (7.5YR 5/6) mottles, reddish yellow (7.5YR 7/6) dry; massive; slightly hard, firm, slightly sticky and plastic; stratified; common very fine discontinuous tubular pores; few thin clay films coating mineral grains; moderately acid.

The thickness of the solum is 40 to 60 inches. The control section is silt loam or silty clay loam and has 0 to 10 percent pebbles.

The A horizon has value of 2 to 6 when moist and dry and chroma of 2 to 4 when moist and dry. The AB horizon has value of 4 or 5 when moist and 5 to 7 when dry and chroma of 2 to 4 when moist and dry. The Bw horizon has value of 4 to 6 when moist and chroma of 2

to 4 when moist. It is silt loam or silty clay loam. It is strongly acid or moderately acid. The C horizon has value of 5 or 6 when moist and 6 to 8 when dry and chroma of 2 or 3 when moist and dry. The content of clay in this horizon is 27 to 35 percent.

Salal Series

The Salal series consists of very deep, moderately well drained soils formed in alluvium. These soils are on flood plains and river terraces. Slopes are 0 to 2 percent. Elevation is 400 to 500 feet. The average annual precipitation is 70 to 80 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 140 to 160 days.

These soils are coarse-silty, mixed, mesic Cumulic Haplumbrepts.

Typical pedon of Salal silt loam, 0 to 2 percent slopes, in King County, about 1 mile north of North Bend, 1,550 feet east and 1,500 feet north of the southwest corner of sec. 4, T. 23 N., R. 8 E.

- Ap—0 to 11 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine pores; strongly acid; abrupt smooth boundary.
- A1—11 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and few fine tubular pores; moderately acid; abrupt wavy boundary.
- A2—18 to 33 inches; very dark grayish brown (2.5Y 3/2) silt loam, grayish brown (2.5Y 5/2) dry; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots in the upper part and few below a depth of 25 inches; common very fine tubular pores; moderately acid; clear wavy boundary.
- AC—33 to 50 inches; very dark grayish brown (2.5Y 3/2) silt loam, light brownish gray (2.5Y 6/2) dry; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; moderately acid; clear wavy boundary.
- C—50 to 60 inches; dark grayish brown (2.5Y 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; common fine distinct olive brown (2.5Y 4/4) mottles, very pale brown (10YR 7/4) dry; weak fine granular structure; hard, friable, slightly sticky and plastic;

few roots; common very fine tubular pores; moderately acid.

The umbric epipedon is 20 to 40 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and chroma of 1 or 2 when moist and dry. It is silt loam or very fine sandy loam. Reaction is strongly acid or moderately acid.

The AC horizon has hue of 2.5Y or 10YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 2 or 3 when moist and dry. It is silt loam or very fine sandy loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 to 8 when dry, and chroma of 2 to 4 when moist and dry. It is silt loam or very fine sandy loam.

Sauk Series

The Sauk series consists of very deep, well drained soils formed in alluvium containing volcanic ash. These soils are on river terraces. Slopes are 0 to 8 percent. Elevation is 500 to 800 feet. The average annual precipitation is 80 to 90 inches, and the mean annual air temperature is about 49 degrees F. The frost-free period is 145 to 165 days.

These soils are coarse-loamy, mixed, mesic Typic Haplorthods.

Typical pedon of Sauk silt loam, 0 to 8 percent slopes, in King County, about 8 miles east of North Bend, 2,000 feet north and 1,500 feet west of the southeast corner of sec. 10, T. 23 N., R. 9 E.

Oi—1.5 inches to 1 inch; undecomposed needles, leaves, and twigs.

Oa—1 inch to 0; decomposed organic mat.

A—0 to 6 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine, common fine, and few medium and coarse roots; many very fine tubular pores; NaF pH 11.0; strongly acid; abrupt wavy boundary.

Bs1—6 to 10 inches; dark brown (7.5YR 3/4) silt loam, dark brown (7.5YR 4/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine and few medium and coarse roots; many very fine and common fine tubular pores; NaF pH 12.0; moderately acid; abrupt wavy boundary.

Bs2—10 to 22 inches; dark yellowish brown (10YR 4/4) fine sandy loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular

blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine and few medium and coarse roots; many very fine and common fine tubular pores; NaF pH 12.0; moderately acid; clear wavy boundary.

Bs3—22 to 34 inches; olive brown (2.5Y 4/4) fine sandy loam, light yellowish brown (2.5Y 6/4) dry; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine, medium, and coarse roots; common very fine and few fine tubular pores; NaF pH 11.5; slightly acid; clear wavy boundary.

BC—34 to 42 inches; dark brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; weakly smeary; few fine, medium, and coarse roots; common very fine and few fine tubular pores; NaF pH 11.5; slightly acid; abrupt smooth boundary.

2C—42 to 60 inches; olive brown (2.5Y 4/4) very gravelly loamy sand, light yellowish brown (2.5Y 6/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many fine irregular pores; about 50 percent pebbles; NaF pH 11.5; slightly acid.

Depth to the C horizon ranges from 40 to 60 inches. The content of rock fragments in the particle-size control section ranges from 0 to 10 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 to 6 when moist and dry. It is silt loam, fine sandy loam, or very fine sandy loam.

The BC horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry. It is sandy loam, fine sandy loam, or very fine sandy loam.

The 2C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is sandy loam, loamy sand, sand, gravelly loamy sand, gravelly sandy loam, very gravelly loamy sand, or very gravelly sand.

Scamman Series

The Scamman series consists of very deep, somewhat poorly drained soils formed in glacial and sedimentary material. These soils are on terraces and on back slopes in the foothills. Slopes are 6 to 65 percent. Elevation is 800 to 1,700 feet. The average

annual precipitation is 40 to 70 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 165 to 185 days.

These soils are fine, mixed, mesic Aquic Palexeralfs.

Typical pedon of Scamman silt loam, 6 to 15 percent slopes, in Pierce County, about 5 miles south of Kapowsin, 2,300 feet north and 2,400 feet east of the southwest corner of sec. 31, T. 17 N., R. 5 E.

Oi—4 to 3 inches; undecomposed needles, leaves, and twigs.

Oa—3 inches to 0; decomposed organic mat.

A—0 to 6 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine and common medium and coarse roots; few very fine irregular and tubular pores; moderately acid; abrupt smooth boundary.

E—6 to 14 inches; light brownish gray (2.5Y 6/2) silt loam, light gray (10YR 7/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine irregular and common very fine tubular pores; moderately acid; abrupt wavy boundary.

Bt1—14 to 27 inches; grayish brown (2.5Y 5/2) silty clay, light gray (5Y 7/2) dry; many medium prominent yellowish brown (10YR 5/6) mottles, reddish yellow (7.5YR 6/8) dry; moderate medium angular blocky structure; very hard, very firm, sticky and plastic; few fine roots; many very fine irregular and few fine tubular pores; many moderately thick clay films in pores and on faces of peds; moderately acid; clear smooth boundary.

Bt2—27 to 60 inches; dark grayish brown (10YR 4/2) silty clay, light gray (5Y 7/2) dry; common medium prominent yellowish brown (10YR 5/6) mottles, reddish yellow (7.5YR 6/8) dry; moderate medium angular blocky structure; very hard, very firm, sticky and plastic; many very fine irregular and few very fine tubular pores; many moderately thick clay films in pores and on faces of peds; slightly acid.

The content of clay in the control section ranges from 40 to 60 percent.

The A horizon has value of 3 or 4 when moist and 4 to 6 when dry and chroma of 3 or 4 when moist and dry.

The E horizon has hue of 10YR or 2.5Y, value of 5 or 6 when moist and 6 or 7 when dry, and chroma of 2 or 3 when moist and dry. It is silt loam or silty clay loam.

The Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 when moist and 6 to 8 when dry, and chroma of 1 or 2 when moist and dry. It is silty clay or clay.

Seattle Series

The Seattle series consists of very deep, very poorly drained soils formed in herbaceous and woody organic deposits. These soils are in river valleys and on glacial till plains. Slopes are 0 to 1 percent. Elevation is 300 to 800 feet. The average annual precipitation is 40 to 50 inches, and the mean annual air temperature is 50 degrees F. The frost-free period is 160 to 180 days.

These soils are euic, mesic Hemic Medisaprists.

Typical pedon of Seattle muck, 0 to 1 percent slopes, in King County, about 7 miles south of Monroe, 1,800 feet north and 1,300 feet east of the southwest corner of sec. 7, T. 26 N., R. 7 E.

Oap—0 to 8 inches; dark brown (7.5YR 4/3) muck, brown (7.5YR 5/3) dry; moderate medium granular structure; very hard, friable, nonsticky and nonplastic; many very fine and fine roots; about 10 percent fiber before rubbing and 5 percent after rubbing; moderately acid; clear smooth boundary.

Oe1—8 to 15 inches; dark brown (7.5YR 3/4) hemic material, brown (7.5YR 5/4) dry; moderate medium platy structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; about 70 percent fiber before rubbing and 17 percent after rubbing; moderately acid; clear smooth boundary.

Oe2—15 to 31 inches; black (5YR 2/1) sapric material, dark reddish brown (5YR 2/2) dry; massive; hard, very friable, nonsticky and nonplastic; common fine roots; about 60 percent fiber before rubbing and 10 percent after rubbing; strongly acid; clear smooth boundary.

Oa—31 to 37 inches; black (5YR 2/1) sapric material, dark reddish brown (5YR 2/2) dry; massive; hard, very friable, nonsticky and nonplastic; about 60 percent fiber before rubbing and 5 percent after rubbing; strongly acid; clear smooth boundary.

O'e—37 to 60 inches; black (5YR 2/1) and dark brown (7.5YR 3/2) hemic material, dark reddish brown (5YR 3/2) and dark brown (7.5YR 3/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; about 50 percent fiber before rubbing and 17 percent after rubbing; strongly acid.

These soils consist of stratified, hemic and sapric material. The content of fiber in the control section ranges from 50 to 70 percent before rubbing and from 5 to 20 percent after rubbing.

The Oa and Oe horizons have hue of 5YR or 7.5YR, value of 2 or 3 when moist and 2 to 5 when dry, and chroma of 1 to 4 when moist and dry.

Serene Series

The Serene series consists of well drained soils formed in a mixture of volcanic ash, pumice, and colluvium derived from granitic and metamorphic rocks. These soils are moderately deep to weathered bedrock. They are on mountain ridge crests and back slopes. Slopes are 8 to 90 percent. Elevation is 3,600 to 6,000 feet. The average annual precipitation is 95 to 100 inches, and the mean annual air temperature is about 40 degrees F. The frost-free period is 90 to 110 days.

These soils are sandy-skeletal, mixed Humic Cryorthods.

Typical pedon of Serene gravelly sandy loam, 8 to 30 percent slopes, in King County, in the upper Hansen Creek drainage, about 100 feet south of a spur off Forest Service Road 2291A, about 1,980 feet west and 1,100 feet north of the southeast corner of sec. 21, T. 22 N., R. 10 E.

Oi—2 inches to 0; loose forest litter, including needles, twigs, bark, and moss.

E—0 to 2 inches; brown (7.5YR 5/2) loamy sand (volcanic ash and pumice), pinkish gray (7.5YR 6/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine roots; many very fine and fine interstitial pores; NaF pH 9.2; very strongly acid; abrupt wavy boundary.

Bhs1—2 to 3 inches; dark brown (7.5YR 3/2) gravelly sandy loam, dark brown (7.5YR 3/4) dry; moderate coarse granular structure; slightly hard, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine roots; many very fine and fine interstitial pores; about 20 percent gravel and hard cinders; NaF pH 12.0+; moderately acid; gradual wavy boundary.

Bhs2—3 to 6 inches; dark reddish brown (5YR 3/3) very gravelly sandy loam, strong brown (7.5YR 4/6) dry; moderate medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; moderately smeary; many very fine and fine and few medium and coarse roots; many very fine and fine interstitial pores; about 40 percent gravel and hard cinders; NaF pH 12.0+; moderately acid; gradual wavy boundary.

Bs—6 to 14 inches; dark yellowish brown (10YR 4/6) very gravelly loamy sand, yellowish brown (10YR 5/6) dry; dark reddish brown (5YR 3/2) stains on

coarse fragments; massive; hard, friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; many fine and medium interstitial pores; about 45 percent gravel and 5 percent cobbles; NaF pH 11.5; moderately acid; abrupt wavy boundary.

BC—14 to 30 inches; olive brown (2.5Y 4/4) extremely cobbly coarse sand, pale yellow (2.5Y 7/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; many fine and medium interstitial pores; about 20 percent gravel and 45 percent cobbles; NaF pH 11.5; moderately acid; gradual smooth boundary.

Cr—30 inches; grayish brown (2.5Y 5/2), highly weathered granodiorite that breaks to very gravelly coarse sand, light brownish gray (2.5Y 6/2) dry; can be dug by a spade with difficulty; about 70 percent hard gravel; moderately acid.

The depth to bedrock is 20 to 40 inches. The content of rock fragments, including hard cinders, in the control section is 35 to 70 percent by volume.

The E horizon has hue of 5YR or 7.5YR or is neutral in hue. It has value of 5 to 7 when moist and 6 to 8 when dry and chroma of 0 to 2 when moist and dry. Reaction is moderately acid to very strongly acid.

The Bhs horizon has hue of 2.5YR, 5YR, or 7.5YR when moist and 5YR or 7.5YR when dry, value of 2 to 5 when moist and 3 to 6 when dry, and chroma of 2 to 6 when moist and 4 to 6 when dry. It is sandy loam or loam in the fine-earth fraction. It has 15 to 55 percent coarse fragments, including hard cinders. Reaction is slightly acid to very strongly acid.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is loamy sand or sandy loam in the fine-earth fraction. It has 30 to 60 percent coarse fragments by volume. Reaction is slightly acid to strongly acid.

The BC horizon has hue of 10YR or 2.5Y, value of 4 to 7 when moist and dry, and chroma of 2 to 6 when moist and dry. It has 40 to 75 percent coarse fragments by volume. Reaction is slightly acid to strongly acid.

Shalcar Series

The Shalcar series consists of very deep, very poorly drained soils formed in herbaceous and woody organic deposits overlying alluvium and glaciofluvial deposits. These soils are in depressions on outwash terraces, till plains, and stream terraces. Slopes are 0 to 1 percent. Elevation is 200 to 700 feet. The average annual precipitation is 35 to 60 inches, and the mean annual

air temperature is about 50 degrees F. The frost-free period is 160 to 180 days.

These soils are loamy, mixed, euic, mesic Terric Medisaprists.

Typical pedon of Shalcar muck, 0 to 1 percent slopes, in King County, about 5 miles east of Buckley, 900 feet north and 2,200 feet west of the southeast corner of sec. 33, T. 20 N., R. 7 E.

Oa1—0 to 2 inches; very dark brown (10YR 2/2) muck, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine roots; many fine irregular pores; about 50 percent fiber before rubbing and 15 percent after rubbing; moderately acid; abrupt smooth boundary.

Oa2—2 to 10 inches; very dark brown (10YR 2/2) muck, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many fine irregular pores; about 20 percent fiber before rubbing and 5 percent after rubbing; moderately acid; abrupt smooth boundary.

Oa3—10 to 16 inches; black (10YR 2/1) sapric material, very dark brown (10YR 2/2) dry; moderate medium granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; many fine irregular pores; about 40 percent fiber before rubbing and 15 percent after rubbing; moderately acid; clear smooth boundary.

Oa4—16 to 20 inches; very dark brown (10YR 2/2) sapric material, very dark grayish brown (10YR 3/2) dry; moderate medium granular structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many fine irregular pores; moderately acid; abrupt smooth boundary.

2C—20 to 60 inches; dark grayish brown (10YR 4/2) sandy loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; many fine irregular pores; slightly acid.

The organic material is 16 to 51 inches thick. The fiber in this material is derived mainly from grasses and sedges, but some pedons contain as much as 10 percent wood fragments. The content of fiber ranges from 5 to 50 percent before rubbing and from 2 to 15 percent after rubbing. The Oa horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 2 to 4 when dry, and chroma of 1 or 2 when moist and dry.

The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 1 or 2 when moist and dry. It is loam, silt loam, or sandy loam. Some pedons are underlain by a sandy 3C horizon.

Si Series

The Si series consists of very deep, moderately well drained soils formed in alluvium. These soils are on river terraces. Slopes are 0 to 2 percent. Elevation is 400 to 500 feet. The average annual precipitation is 70 to 80 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 140 to 160 days.

These soils are coarse-silty, mixed, nonacid, mesic Typic Udifluvents.

Typical pedon of Si silt loam, 0 to 2 percent slopes, in King County, about 2 miles north of North Bend, 1,650 feet south and 2,540 feet east of the northwest corner of sec. 34, T. 24 N., R. 8 E.

Ap—0 to 11 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; strong medium and coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine and few fine tubular pores; moderately acid; abrupt smooth boundary.

Bw—11 to 22 inches; olive brown (2.5Y 4/4) silt loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine irregular and common fine tubular pores; moderately acid; abrupt smooth boundary.

C1—22 to 39 inches; light olive brown (2.5Y 5/4), stratified silt loam and fine sandy loam, light yellowish brown (2.5Y 6/4) and light gray (2.5Y 7/2) dry; massive; soft, very friable, nonsticky and nonplastic; very few very fine roots; many very fine irregular and common fine tubular pores; moderately acid; clear wavy boundary.

C2—39 to 60 inches; olive brown (2.5Y 4/4) and grayish brown (2.5Y 5/2), stratified silt loam and fine sandy loam, light yellowish brown (2.5Y 6/4) and light gray (2.5Y 7/2) dry; massive; soft, very friable, nonsticky and nonplastic; very few very fine tubular pores; few roots; moderately acid.

The Ap horizon has hue of 10YR or 2.5Y, value of 5 or 6 when dry, and chroma of 2 or 3 when moist and dry. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 2 to 4 when moist and dry. The C horizon has hue of 2.5Y or 5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and dry. It is dominantly stratified silt loam and fine sandy loam. In some pedons, however, it has some thin strata of loamy fine sand or fine sand. It is moderately acid or slightly acid.

Skykomish Series

The Skykomish series consists of very deep, somewhat excessively drained soils formed in a mixture of volcanic ash and glacial outwash. These soils are on terraces and escarpments. Slopes are 0 to 65 percent. Elevation is 1,000 to 1,800 feet. The average annual precipitation is 50 to 80 inches, and the mean annual air temperature is about 45 degrees F. The frost-free period is 120 to 140 days.

These soils are sandy-skeletal, mixed, frigid Typic Haplorthods.

Typical pedon of Skykomish gravelly sandy loam, 0 to 30 percent slopes, in King County, about 5 miles east of North Bend, 1,000 feet west and 600 feet north of the southeast corner of sec. 4, T. 23 N., R. 9 E.

Oi—2 inches to 0.5 inch; undecomposed needles, leaves, and twigs.

Oa—0.5 inch to 0; decomposed organic mat.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, dark brown (10YR 4/3) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium roots; many fine irregular pores; about 15 percent pebbles; moderately acid; abrupt smooth boundary.

Bs1—6 to 10 inches; reddish brown (5YR 4/4) gravelly sandy loam, yellowish red (5YR 5/6) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and common fine and medium roots; many fine irregular pores; about 20 percent pebbles; moderately acid; abrupt irregular boundary.

Bs2—10 to 15 inches; yellowish red (5YR 4/6) very gravelly sandy loam, reddish yellow (5YR 6/6) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and common fine and medium roots; many fine irregular pores; about 35 percent pebbles; moderately acid; clear irregular boundary.

Bs3—15 to 24 inches; dark brown (7.5YR 4/4) very gravelly loamy sand, reddish yellow (7.5YR 6/6) dry; single grain; loose; many very fine and common fine and medium roots; about 45 percent pebbles and 10 percent cobbles; moderately acid; abrupt wavy boundary.

2C1—24 to 32 inches; dark grayish brown (10YR 4/2) extremely gravelly coarse sand, pale brown (10YR 6/3) dry; massive; hard, very firm, nonsticky and nonplastic; few very fine and fine roots; many fine irregular pores; about 50 percent pebbles and 10

percent cobbles; moderately acid; abrupt wavy boundary.

2C2—32 to 60 inches; dark brown (10YR 4/3) extremely gravelly coarse sand, light yellowish brown (10YR 6/4) dry; single grain; loose; few very fine and fine roots; many fine irregular pores; about 60 percent pebbles and 10 percent cobbles; moderately acid.

The thickness of the solum is 14 to 30 inches. The content of rock fragments ranges from 35 to 50 percent in the upper part of the particle-size control section and from 60 to 80 percent in the lower part. Some pedons have 10 to 20 percent stones on the surface and throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 4 to 6 when moist and dry. It is dominantly gravelly loam, gravelly sandy loam, very gravelly loam, very gravelly sandy loam, or very stony sandy loam. In some pedons, however, the Bs3 horizon is very gravelly loamy sand.

The 2C horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry. It is extremely gravelly loamy sand, extremely gravelly sand, extremely gravelly coarse sand, or extremely stony sand.

Snoqualmie Series

The Snoqualmie series consists of very deep, somewhat excessively drained soils formed in gravelly alluvium. These soils are on low river terraces. Slopes are 0 to 8 percent. Elevation is 800 to 1,700 feet. The average annual precipitation is 50 to 90 inches, and the mean annual air temperature is about 48 degrees F. The frost-free period is 150 to 170 days.

These soils are sandy-skeletal, mixed, mesic Dystric Xerorthents.

Typical pedon of Snoqualmie loamy fine sand, 0 to 8 percent slopes, in King County, about 10 miles east of Enumclaw, 1,800 feet west and 1,250 feet south of the northeast corner of sec. 3, T. 19 N., R. 8 E.

Oi—1 inch to 0; undecomposed needles, leaves, and twigs; abrupt smooth boundary.

A—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; single grain; loose; many very fine, fine, and medium and common coarse roots; moderately acid (pH 6.0); abrupt smooth boundary.

2C1—8 to 36 inches; very dark gray (10YR 3/1) extremely gravelly coarse sand, dark gray (N 4/0) dry; single grain; loose; common fine, medium, and coarse and few very fine roots; about 50 percent pebbles and 20 percent cobbles; moderately acid; abrupt smooth boundary.

2C2—36 to 60 inches; very dark gray (10YR 3/1) extremely cobbly coarse sand, dark gray (N 4/0) dry; single grain; loose; about 40 percent pebbles and 25 percent cobbles; slightly acid.

Depth to the 2C horizon is 6 to 20 inches. The particle-size control section has 40 to 70 percent rock fragments. The control section is extremely gravelly or extremely cobbly coarse sand. The upper 40 inches has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 to 4 when moist and 4 or 5 when dry and chroma of 1 to 3 when moist and 0 to 2 when dry.

Spukwush Series

The Spukwush series consists of very deep, well drained soils formed in volcanic ash and cinders over highly weathered tuffaceous material. These soils are in mountainous slump areas. Slopes are 8 to 30 percent. Elevation is 2,700 to 4,000 feet. The average annual precipitation is 70 to 100 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 110 to 130 days.

These soils are ashy over loamy, mixed Typic Cryorthods.

Typical pedon of Spukwush loamy sand, 8 to 30 percent slopes, in King County, 1,000 feet north and 1,200 feet east of the southwest corner of sec. 17, T. 19 N., R. 10 E.

A—0 to 2 inches; brown (7.5YR 4/4) loamy sand (volcanic ash and pumice), pinkish gray (7.5YR 6/2) dry; single grain; loose, nonsticky and nonplastic; few medium and coarse and common very fine and fine roots; about 10 percent cinders 2 to 6 millimeters in diameter; strongly acid; abrupt smooth boundary.

Bs1—2 to 4 inches; strong brown (7.5YR 5/6) loamy sand (volcanic ash and pumice), light yellowish brown (10YR 6/4) dry; single grain; loose, nonsticky and nonplastic; few medium and coarse and common very fine and fine roots; about 15 percent cinders 2 to 6 millimeters in diameter; strongly acid; abrupt smooth boundary.

Bs2—4 to 7 inches; strong brown (7.5YR 5/6) and pale brown (10YR 6/3) loamy sand (volcanic ash and pumice), variegated strong brown (7.5YR 5/6) and white (10YR 8/1) dry; single grain; loose, nonsticky

and nonplastic; weakly smeary; few medium and common very fine and fine roots; about 5 percent cinders 2 to 6 millimeters in diameter and 5 percent pebbles; strongly acid; clear smooth boundary.

Bs3—7 to 15 inches; brown (10YR 5/3) very cindery sandy loam (volcanic ash and pumice), very pale brown (10YR 7/4) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; few medium and coarse and common fine roots; about 20 percent pebbles and 30 percent cinders 2 to 6 millimeters in diameter; strongly acid; abrupt smooth boundary.

2Bsb1—15 to 30 inches; yellowish brown (10YR 5/4) loam, very pale brown (10YR 8/3) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and medium roots; few very fine and fine irregular pores; about 3 percent pebbles; moderately acid; clear smooth boundary.

2Bsb2—30 to 36 inches; light yellowish brown (10YR 6/4) loam, very pale brown (10YR 8/3) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; yellowish brown (10YR 5/8) and light gray (10YR 7/2) bands, reddish yellow (7.5YR 6/8) dry; few very fine and fine irregular pores; about 10 percent pebbles; moderately acid; clear smooth boundary.

2Cb1—36 to 39 inches; light yellowish brown (10YR 6/4) loam that has white (10YR 8/1) and very pale brown (10YR 7/3) bands when dry; white (10YR 8/1) flakes; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine random tubular and irregular pores; about 10 percent pebbles; moderately acid; clear smooth boundary.

2Cb2—39 to 60 inches; light yellowish brown (10YR 6/4) gravelly loam, very pale brown (10YR 8/3) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine random, tubular and irregular pores; about 20 percent pebbles; slightly acid.

The solum is 24 to 40 inches thick. The lower part of the control section ranges from 15 to 30 percent rock fragments and from 18 to 27 percent clay. The ashy material is 14 to 24 inches thick.

The A horizon has hue of 7.5YR or 10YR, value of 4 to 6 when moist and 6 or 7 when dry, and chroma of 1 to 4 when moist and 1 or 2 when dry.

The Bs horizon has matrix colors with hue of 7.5YR or 10YR, value of 4 to 6 when moist and 5 to 7 when dry, and chroma of 3 to 6 when moist and dry. It is loamy sand or sandy loam in the fine-earth fraction. It has 5 to 30 percent pumice and cinders.

The 2Bsb horizon is loam or clay loam. It has 2 to 15 percent pebbles.

The 2Cb horizon has hue of 7.5YR or 10YR, value of 4 to 6 when moist and 7 or 8 when dry, and chroma of 1 to 4 when moist and dry. It has 5 to 25 percent pebbles. Reaction is slightly acid or moderately acid.

Stahl Series

The Stahl series consists of well drained soils formed in a mixture of volcanic ash and residuum and colluvium derived from andesite or breccia and tuff. These soils are moderately deep to bedrock. They are on mountain back slopes. Slopes are 15 to 65 percent. Elevation is 2,700 to 4,700 feet. The average annual precipitation is 80 to 100 inches, and the mean annual air temperature is about 42 degrees F. The frost-free period is 140 to 160 days.

These soils are medial-skeletal Andic Cryumbrepts.

Typical pedon of Stahl very gravelly silt loam, 30 to 65 percent slopes, in Pierce County, about 5.5 miles southeast of Ohop, 2,800 feet east and 700 feet north of the southwest corner of sec. 6, T. 16 N., R. 6 E.

Oi—4 inches to 0; undecomposed needles, twigs, bark, and leaves.

A—0 to 8 inches; dark brown (10YR 3/3) very gravelly silt loam, brown (10YR 5/3) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; about 25 percent pebbles and 10 percent cobbles; strongly acid; clear smooth boundary.

Bw—8 to 15 inches; dark brown (10YR 4/3) very gravelly silt loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; about 35 percent pebbles, 10 percent cobbles, and 10 percent stones; strongly acid; clear smooth boundary.

C—15 to 29 inches; dark brown (10YR 4/3) extremely cobbly silty clay loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; many fine irregular pores; about 40 percent pebbles and 30 percent cobbles; moderately acid; abrupt smooth boundary.

R—29 inches; andesite.

The depth to bedrock is 20 to 40 inches. The content of rock fragments in the particle-size control section ranges from 60 to 80 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is very gravelly silt loam or very gravelly silty clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and dry. It is extremely cobbly silt loam or extremely cobbly silty clay loam.

Sulsavar Series

The Sulsavar series consists of very deep, well drained soils formed in volcanic ash and alluvium. These soils are on alluvial fans and terraces. Slopes are 0 to 8 percent. Elevation is 1,100 to 1,500 feet. The average annual precipitation is 45 to 75 inches, and the mean annual air temperature is about 46 degrees F. The frost-free period is 140 to 160 days.

These soils are coarse-loamy, mixed, mesic Typic Haplorthods.

Typical pedon of Sulsavar loam, 0 to 8 percent slopes, in King County, about 2 miles northeast of the Eagle Gorge Reservoir Dam, 1,500 feet west and 400 feet south of the northeast corner of sec. 22, T. 21 N., R. 8 E.

Oi—2 inches to 0; undecomposed needles, leaves, twigs, and bark.

A1—0 to 12 inches; dark brown (7.5YR 4/4) loam, brown (7.5YR 5/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine, fine, medium, and coarse roots; many very fine irregular pores; about 2 percent pebbles; moderately acid; gradual smooth boundary.

A2—12 to 28 inches; dark brown (7.5YR 3/4) loam, dark brown (7.5YR 4/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine, fine, and medium and few coarse roots; many very fine irregular pores; about 5 percent pebbles; slightly acid; clear smooth boundary.

Bs—28 to 47 inches; yellowish brown (10YR 5/4) sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine roots; many very fine irregular pores; about 5 percent pebbles; slightly acid; abrupt smooth boundary.

2C1—47 to 51 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) loam, light

yellowish brown (10YR 6/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; weakly smeary; many very fine irregular pores; about 10 percent pebbles; slightly acid; abrupt smooth boundary.

3C2—51 to 60 inches; dark brown (10YR 3/3) and dark yellowish brown (10YR 4/4) very gravelly loam, yellowish brown (10YR 5/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; weakly smeary; many very fine irregular pores; about 55 percent pebbles; slightly acid.

The content of rock fragments ranges from 5 to 15 percent in the particle-size control section and from 15 to 50 percent below a depth of 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 to 5 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 4 to 6 when moist and dry. It is silt loam, loam, sandy loam, or gravelly loam.

The 2C and 3C horizons have hue of 10YR or 2.5Y, value of 3 to 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist and dry. They are stratified loam to very gravelly loamy sand.

Sultan Series

The Sultan series consists of very deep, moderately well drained soils formed in alluvium. These soils are on river terraces. Slopes are 0 to 2 percent. Elevation is 50 to 120 feet. The average annual precipitation is 35 to 55 inches, and the mean annual air temperature is 50 degrees F. The frost-free period is 165 to 185 days.

These soils are fine-silty, mixed, nonacid, mesic Aquic Xerofluvents.

Typical pedon of Sultan silt loam, 0 to 2 percent slopes, in King County, about 1 mile north of Carnation, 2,140 feet west and 250 feet north of the southeast corner of sec. 9, T. 25 N., R. 7 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; hard, firm, sticky and plastic; many roots; slightly acid; abrupt smooth boundary.

Bw1—9 to 21 inches; yellowish brown (10YR 5/4) silty clay loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many roots; slightly acid; clear wavy boundary.

Bw2—21 to 24 inches; light olive brown (2.5Y 5/4) silt loam, pale yellow (2.5Y 7/4) dry; many medium

prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common roots; neutral; clear wavy boundary.

Bg—24 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam, white (2.5Y 8/2) dry; many medium prominent yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure; slightly hard, very friable, sticky and plastic; few roots; neutral; clear wavy boundary.

Cg—48 to 60 inches; olive gray (5Y 5/2) very fine sandy loam stratified with sand; light gray (2.5Y 7/2) dry; common fine prominent yellowish red (5YR 4/6) mottles; massive; slightly hard, very friable; few roots; very strongly acid.

The Ap horizon has value of 3 or 4 when moist and 5 or 6 when dry and chroma of 2 or 3 when moist and dry. Reaction is slightly acid or neutral.

The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 3 or 4 when moist and dry. It is silt loam or silty clay loam. Reaction is slightly acid or neutral.

The Bg horizon has hue of 5Y or 2.5Y, value of 4 to 7 when moist and 5 to 8 when dry, and chroma of 1 or 2 when moist and dry. It is silt loam, very fine sandy loam, or silty clay loam. Reaction is slightly acid or neutral.

The Cg horizon has hue of 5Y or 2.5Y or is neutral in hue. It has value of 4 to 7 when moist and 5 to 8 when dry and chroma of 0 to 2 when moist and dry. It is stratified silt loam to sand. Reaction is very strongly acid to neutral.

Teneriffe Series

The Teneriffe series consists of deep and very deep, well drained soils formed in volcanic ash and pumice over colluvium derived from granitic and low-grade metamorphic rocks. These soils are on mountain back slopes. Slopes are 8 to 65 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 90 to 130 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 135 to 155 days.

These soils are sandy-skeletal, mixed, frigid Typic Haplorthods.

Typical pedon of Teneriffe loamy sand, 30 to 60 percent slopes, in King County, along Forest Service Road 2218A, about 1,200 feet west and 200 feet south of the northeast corner of sec. 7, T. 22 N., R. 10 E.

Oi—3 to 2 inches; moss, needles, and twigs.

Oa—2 inches to 0; decomposed forest litter.

E—0 to 1 inch; brown (7.5YR 4/2) loamy sand, pinkish gray (7.5YR 6/2) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine and common medium roots; about 5 percent subangular pebbles; NaF pH less than 9.2; strongly acid; abrupt smooth boundary.

Bhs—1 to 11 inches; dark brown (7.5YR 3/4) loamy sand (volcanic ash and pumice), brown (7.5YR 5/4) dry; weak very fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and common medium and coarse roots; about 10 percent subangular pebbles; NaF pH 12.0+; moderately acid; gradual wavy boundary.

2Bs—11 to 21 inches; strong brown (7.5YR 4/6) gravelly loamy sand, reddish yellow (7.5YR 6/6) dry; weak very fine and fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine, common fine, and few medium roots; about 20 percent subangular pebbles and 5 percent cobbles; NaF pH 11.5; moderately acid; clear wavy boundary;

2BC1—21 to 26 inches; olive brown (2.5Y 4/4) very gravelly loamy sand, pale yellow (2.5Y 7/4) dry; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine roots; about 30 percent pebbles and 5 percent cobbles; NaF pH 11.0; moderately acid; clear wavy boundary.

2BC2—26 to 37 inches; light olive brown (2.5Y 5/4) very gravelly loamy sand, pale yellow (2.5Y 8/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and few coarse roots; about 40 percent pebbles and 5 percent cobbles; NaF pH 10.5; moderately acid; clear wavy boundary.

2C—37 to 60 inches; light yellowish brown (10YR 6/4) very gravelly coarse sand, very pale brown (10YR 8/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; nonsmeary; few very fine roots; about 55 percent pebbles; NaF pH 10.0; slightly acid.

In some areas weathered shale is at a depth of 40 to 60 inches. The content of rock fragments, including hard cinders, in the particle-size control section ranges from 35 to 60 percent by volume.

The E horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6 when moist and 6 to 8 when dry, and chroma of 1 or 2 when moist and dry.

The Bhs horizon has hue of 5YR or 7.5YR, value of

3 to 5 when moist and 5 to 7 when dry, and chroma of 4 to 6 when moist and dry. The content of rock fragments is 10 to 30 percent by volume. Reaction is strongly acid or moderately acid.

The 2Bs horizon has value of 4 or 5 when moist and 6 or 7 when dry and chroma of 4 to 6 when moist and dry. The content of rock fragments is 25 to 40 percent by volume. Reaction is strongly acid or moderately acid.

The 2BC horizon has hue of 10YR or 2.5Y, value of 4 to 6 when moist and 7 or 8 when dry, and chroma of 3 or 4 when moist and dry. The content of rock fragments is 35 to 60 percent by volume. Reaction is slightly acid or moderately acid.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6 when moist and 6 to 8 when dry, and chroma of 2 to 4 when moist and dry. It is loamy sand, sand, or coarse sand in the fine-earth fraction. It has 50 to 70 percent rock fragments by volume. Reaction is slightly acid or moderately acid.

Tokul Series

The Tokul series consists of moderately well drained soils formed in a mixture of volcanic ash and dense glacial till. These soils are moderately deep to ortstein. They are on mountain foot slopes and in valleys. Slopes are 0 to 90 percent. Elevation is 600 to 1,100 feet. The average annual precipitation is 50 to 70 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 160 to 180 days.

These soils are coarse-loamy, mixed, mesic, ortstein Typic Haplorthods.

Typical pedon of Tokul gravelly loam, 6 to 15 percent slopes, in King County, about 5 miles east of Maple Valley, 1,000 feet south and 200 feet east of the northwest corner of sec. 17, T. 22 N., R. 7 E.

Oi—0.5 inch to 0; undecomposed needles and leaves.

A—0 to 3 inches; very dark brown (10YR 2/2) gravelly loam, dark brown (10YR 4/3) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; many very fine and fine roots; few very fine tubular pores; about 30 percent pebbles; strongly acid; clear wavy boundary.

Bs1—3 to 9 inches; dark yellowish brown (10YR 3/4) gravelly loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; common fine roots; few very fine tubular pores; about 30 percent pebbles; strongly acid; clear wavy boundary.

Bs2—9 to 19 inches; dark yellowish brown (10YR 3/4)

gravelly loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; common very fine tubular pores; about 30 percent pebbles; strongly acid; gradual wavy boundary.

Bs3—19 to 31 inches; dark yellowish brown (10YR 3/4) gravelly loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium roots; common fine tubular pores; strongly acid; gradual wavy boundary.

BC—31 to 37 inches; dark yellowish brown (10YR 4/4) gravelly fine sandy loam, light yellowish brown (2.5Y 6/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few very fine and fine roots; common fine tubular pores; about 30 percent pebbles; moderately acid; gradual wavy boundary.

2Bsm—37 to 60 inches; dark grayish brown (2.5Y 4/2) ortstein that crushes to very gravelly sandy loam, light brownish gray (2.5Y 6/2) dry; massive; hard, firm, nonsticky and nonplastic; about 50 percent pebbles; moderately acid.

Depth to the 2Bsm horizon is 20 to 40 inches. The content of rock fragments in the particle-size control section ranges from 15 to 35 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 1 to 3 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 to 6 when moist and 4 to 7 when dry, and chroma of 4 to 6 when moist and dry. It is gravelly loam, gravelly silt loam, or gravelly fine sandy loam.

The BC horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 when moist and 5 to 7 when dry, and chroma of 2 to 4 when moist and dry. It is gravelly sandy loam, gravelly fine sandy loam, or gravelly loam.

The 2Bsm horizon is ortstein that crushes to gravelly loam, gravelly sandy loam, very gravelly loam, or very gravelly sandy loam. It has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and dry.

Treen Series

The Treen series consists of well drained soils formed in a mixture of volcanic ash and material weathered from a wide variety of rocks. These soils are shallow to bedrock. They are on high mountain slopes and ridge crests. Slopes are 30 to 90 percent. Elevation is 3,200 to 5,000 feet. The average annual precipitation

is 70 to 130 inches, and the mean annual air temperature is about 40 degrees F. The frost-free period is 80 to 100 days.

These soils are medial Lithic Cryandepts.

Typical pedon of Treen loam, 30 to 90 percent slopes, in King County, near Captain Point, 800 feet north and 2,500 feet west of the southeast corner of sec. 6, T. 26 N., R. 13 E.

Oi—2 inches to 0; matted herbaceous material; fibrous.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; moderately smeary; many very fine and fine roots; common very fine irregular pores; about 10 percent pebbles; about 25 percent organic fiber by volume; moderately acid; NaF pH 10.5; abrupt smooth boundary.

A2—5 to 14 inches; dark brown (7.5YR 3/2) sandy loam, brown (7.5YR 4/2) dry; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common very fine, fine, medium, and coarse roots; common fine irregular pores; about 10 percent pebbles; strongly acid; NaF pH 12.0; clear smooth boundary.

Bw—14 to 18 inches; brown (7.5YR 5/4) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; common fine irregular pores; about 25 percent pebbles; moderately acid; NaF pH 11.5; abrupt smooth boundary.

R—18 inches; schist.

The depth to metamorphic or granitic bedrock is 14 to 20 inches. Reaction is moderately acid or strongly acid throughout the profile. The bulk density in the A1 and A2 horizons is estimated to be less than 0.85 grams per cubic centimeter.

The A1 horizon has hue of 10YR or 7.5YR, value of 4 or 5 when dry, and chroma of 2 or 3 when dry. It has 0 to 10 percent coarse volcanic ash.

The A2 horizon has hue of 7.5YR or 10YR and chroma of 2 or 3 when dry. It is sandy loam or loam in the fine-earth fraction. It has 0 to 10 percent coarse volcanic ash and 10 to 25 percent pebbles.

The Bw horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6 when moist and 5 to 7 when dry, and chroma of 2 to 6 when moist and dry. It is loam, gravelly sandy loam, or gravelly fine sandy loam. It has 10 to 30 percent coarse fragments.

Tukwila Series

The Tukwila series consists of very deep, very poorly drained soils formed in herbaceous and woody organic deposits stratified with mineral layers. These soils are in depressions on stream terraces. Slopes are 0 to 1 percent. Elevation is 100 to 500 feet. The average annual precipitation is 40 to 50 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 160 to 180 days.

These soils are diatomaceous, dysic, mesic Limnic Medisaprists.

Typical pedon of Tukwila muck, 0 to 1 percent slopes, in King County, about 2.5 miles south of Carnation, 750 feet south and 2,000 feet west of the northeast corner of sec. 33, T. 25 N., R. 7 E.

- Oa1—0 to 10 inches; black (5YR 2/1) muck, dark reddish brown (5YR 3/2) dry; moderate coarse granular structure; very hard, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many fine irregular pores; about 50 percent fiber before rubbing and 5 percent after rubbing; strongly acid; clear smooth boundary.
- Oa2—10 to 22 inches; black (5YR 2/1) sapric material, dark reddish brown (5YR 3/2) dry; moderate coarse prismatic structure; very hard, very friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many fine irregular pores; about 40 percent fiber before rubbing and 10 percent after rubbing; strongly acid; clear smooth boundary.
- Oa3—22 to 41 inches; dark reddish brown (5YR 2/2) sapric material, dark reddish brown (5YR 2/2) dry; massive; very hard, very friable, nonsticky and nonplastic; many fine irregular pores; about 40 percent fiber before rubbing and 5 percent after rubbing; strongly acid; clear smooth boundary.
- 2C—41 to 44 inches; dark brown (7.5YR 4/2) and pinkish gray (7.5YR 6/2) fine sandy loam (diatomaceous earth), pinkish gray (7.5YR 7/2) and light gray (N 7/0) dry; massive; hard, friable, nonsticky and nonplastic; many fine irregular pores; strongly acid; abrupt smooth boundary.
- 3O'a—44 to 51 inches; dark reddish brown (5YR 2/2) sapric material, dark reddish brown (5YR 3/2) dry; massive; hard, very friable, nonsticky and nonplastic; many fine irregular pores; strongly acid; abrupt smooth boundary.
- 4C'1—51 to 54 inches; gray (5Y 5/1) and very dark brown (10YR 2/2) silt loam (diatomaceous earth), light gray (5Y 7/1) and dark grayish brown (10YR 4/2) dry; many coarse prominent brownish yellow (10YR 6/6) mottles, yellow (10YR 7/6) dry; massive;

slightly hard, friable, slightly sticky and plastic; many fine irregular pores; strongly acid; abrupt smooth boundary.

5C'2—54 to 57 inches; brownish yellow (10YR 6/6) fine sandy loam (diatomaceous earth), yellow (10YR 8/6) dry; massive; slightly hard, friable, nonsticky and nonplastic; many fine irregular pores; strongly acid; abrupt smooth boundary.

6C'3—57 to 60 inches; black (10YR 2/1) and dark brown (7.5YR 4/2), stratified muck (50 percent) and silt loam (50 percent), dark brown (7.5YR 3/2) and pinkish gray (7.5YR 7/2) dry; massive; very hard, friable, nonsticky and nonplastic; many fine irregular pores; strongly acid.

The organic material extends to a depth of 51 inches or more. The Oa horizon has hue of 5YR, 7.5YR, or 10YR, value of 2 or 3 when dry, and chroma of 1 or 2 when moist and dry. The mineral horizons have hue of 7.5YR to 5Y, value of 4 to 6 when moist and 5 to 8 when dry, and chroma of 2 to 6 when moist and dry. They are made up of diatomaceous earth or volcanic ash. They are silt loam, loam, or fine sandy loam.

Tusip Series

The Tusip series consists of deep, well drained soils formed in volcanic ash, pumice, and cinders over residuum and colluvium derived from weathered sandstone. These soils are on rounded ridgetops and mountain back slopes. Slopes are 15 to 65 percent. Elevation is 2,700 to 3,600 feet. The average annual precipitation is 80 to 100 inches, and the mean annual temperature is about 42 degrees F. The frost-free period is 120 to 140 days.

These soils are ashy over loamy, mixed Typic Cryorthods.

Typical pedon of Tusip sandy loam, 30 to 65 percent slopes, in Pierce County, about 9 miles south of Fairfax, along St. Regis Road 21, about 2,500 feet east and 300 feet north of the southwest corner of sec. 14, T. 16 N., R. 6 E.

Oi&Oe—1 inch to 0; loose forest litter, including needles, moss, and partially decayed leaves, bark, and roots.

A—0 to 2 inches; dark brown (10YR 4/3) sandy loam (volcanic ash and cinders), brown (10YR 5/3) dry; single grain; loose, nonsticky and nonplastic; weakly smeary; many very fine and fine roots; about 5 percent soft subangular sandstone pebbles and 10 percent hard cinders; moderately acid; abrupt smooth boundary.

Bs1—2 to 6 inches; dark brown (7.5YR 4/4) sandy loam

(volcanic ash and cinders), light brown (7.5YR 6/4) dry; single grain; loose, nonsticky and nonplastic; weakly smeary; many very fine and fine and few medium roots; about 5 percent soft subangular sandstone pebbles and 10 percent hard cinders; strongly acid; abrupt smooth boundary.

Bs2—6 to 15 inches; strong brown (7.5YR 4/6) loamy sand (volcanic ash and cinders), reddish yellow (7.5YR 6/6) dry; single grain; loose, nonsticky and nonplastic; weakly smeary; many very fine and fine and few medium roots; about 5 percent soft and 5 percent hard subangular sandstone pebbles and 10 percent hard cinders; strongly acid; abrupt smooth boundary.

2Bs3—15 to 28 inches; yellowish brown (10YR 5/6) gravelly sandy loam, very pale brown (10YR 7/4) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; moderately smeary; few very fine, fine, and medium roots; about 15 percent hard and 15 percent soft subangular sandstone pebbles; strongly acid; clear irregular boundary.

2Bs4—28 to 38 inches; yellowish brown (10YR 5/8) gravelly fine sandy loam, yellow (10YR 7/6) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; weakly smeary; few very fine roots; about 30 percent hard sandstone pebbles and 20 percent soft subangular sandstone pebbles; moderately acid; abrupt smooth boundary.

2Bs5—38 to 43 inches; yellowish brown (10YR 5/8) very gravelly fine sandy loam, yellow (10YR 7/6) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; weakly smeary; about 40 percent hard sandstone pebbles and 20 percent soft subangular sandstone pebbles; strongly acid; abrupt smooth boundary.

2Cr—43 inches; weathered sandstone that can be cut by a spade.

The depth to paralithic contact is 40 to 60 inches. Reaction is moderately acid or strongly acid throughout the profile.

The A horizon has value of 3 or 4 when moist and 4 or 5 when dry and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is sandy loam or loamy sand. It has 5 to 10 percent hard cinders.

The 2Bs horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6 when moist and 5 to 8 when dry, and chroma of 4 to 8 when moist and 4 to 6 when dry. It is gravelly sandy loam, gravelly fine sandy loam, or very

gravelly fine sandy loam. It has 15 to 40 percent hard pebbles.

Typic Haplorthods

Typic Haplorthods consist of moderately deep and deep, well drained soils formed in volcanic ash, glacial drift, and colluvium. They are on glacially modified mountainsides and canyonsides. Slopes are 35 to 100 percent. Elevation is 1,000 to 2,500 feet. The average annual precipitation is 50 to 80 inches, and the mean annual air temperature is about 47 degrees F. The frost-free period is 130 to 150 days.

Typical pedon of Typic Haplorthods, 35 to 100 percent slopes, in Pierce County, about 2 miles southeast of Kapowsin, 2,200 feet west and 400 feet south of the northeast corner of sec. 17, T. 17 N., R. 5 E.

Oa—2 inches to 0; decomposed needles and leaves.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common coarse roots; many very fine irregular pores; about 40 percent pebbles; strongly acid; clear smooth boundary.

Bs1—3 to 12 inches; dark brown (10YR 3/3) very gravelly loam, pale brown (10YR 6/3) dry; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine irregular pores; about 40 percent pebbles; strongly acid; clear smooth boundary.

Bs2—12 to 22 inches; dark brown (10YR 4/3) very gravelly loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine irregular pores; about 40 percent pebbles; moderately acid; clear smooth boundary.

Bs3—22 to 32 inches; olive brown (2.5Y 4/4) very gravelly loam, light yellowish brown (2.5Y 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common very fine irregular pores; about 50 percent pebbles; strongly acid; clear smooth boundary.

C—32 to 45 inches; dark brown (10YR 4/3) and light olive brown (2.5Y 5/4) very gravelly loam, yellowish brown (10YR 5/4) and pale yellow (2.5Y 7/4) dry; massive; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common fine irregular pores; about 55 percent pebbles; moderately acid; abrupt smooth boundary.

Cd—45 to 60 inches; grayish brown (2.5Y 5/2), dense glacial till that crushes to extremely gravelly loamy sand, light gray (2.5Y 7/1) dry; massive; very hard, firm, slightly sticky and slightly plastic; common fine and medium pores; about 65 percent pebbles; strongly acid.

The depth to dense glacial till or bedrock is 20 to 60 inches. The thickness of the solum is 18 to 40 inches. The content of rock fragments in the particle-size control section is 35 to 60 percent.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and chroma of 2 to 4 when moist and dry.

The Bs horizon has value of 3 or 4 when moist and 4 to 6 when dry and chroma of 3 or 4 when moist and dry. It is very gravelly loam or very gravelly sandy loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 2 to 4 when moist and dry. It is very gravelly loam or very gravelly sandy loam.

The Cd horizon is dense glacial till that crushes to very gravelly loam, very gravelly sandy loam, very gravelly loamy sand, or extremely gravelly loamy sand. It has hue of 2.5Y or 5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist and dry.

Typic Udifluvents

Typic Udifluvents consist of very deep, well drained soils formed in alluvium. They are on low stream terraces and in drainageways. Slopes are 0 to 3 percent. Elevation is 1,000 to 2,500 feet. The average annual precipitation is 60 to 80 inches, and the mean annual air temperature is about 46 degrees F. The frost-free period is 140 to 160 days.

Typical pedon of Typic Udifluvents, 0 to 3 percent slopes, in King County, about 5 miles southeast of Maple Valley, 2,400 feet west and 2,500 feet north of the southeast corner of sec. 17, T. 22 N., R. 7 E.

Oi—0.5 inch to 0; undecomposed needles, leaves, and twigs.

A—0 to 5 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots; many very fine irregular pores; strongly acid; clear wavy boundary.

Bw—5 to 16 inches; dark yellowish brown (10YR 3/4) silt loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and slightly plastic; common very fine and

fine roots; many fine irregular pores; strongly acid; clear wavy boundary.

C1—16 to 31 inches; dark yellowish brown (10YR 3/4) fine sandy loam, yellowish brown (10YR 5/4) dry; massive; soft, very friable, nonsticky and nonplastic; common fine and few coarse roots; many fine irregular pores; moderately acid; clear wavy boundary.

C2—31 to 60 inches; dark yellowish brown (10YR 3/4) sandy loam, yellowish brown (10YR 5/4) dry; massive; soft, very friable, nonsticky and nonplastic; few coarse roots; many fine irregular pores; moderately acid.

The depth to stratified loamy or sandy material ranges from 15 to 50 inches.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 3 to 5 when dry, and chroma of 2 or 3 when moist and dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist and dry. It is silt loam or fine sandy loam.

The C horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 to 6 when moist and dry. It is dominantly fine sandy loam or sandy loam but in some pedons is stratified with gravelly coarse sand.

Udifluvents

Udifluvents consist of very deep, well drained soils formed in alluvium. They are on low stream terraces and in drainageways. Slopes are 0 to 8 percent. Elevation is 1,300 to 2,500 feet. The average annual precipitation is 60 to 80 inches, and the mean annual air temperature is about 44 degrees F. The frost-free period is 140 to 160 days.

Typical pedon of Udifluvents, moist, 0 to 8 percent slopes, in King County, about 4 miles southeast of Greenwater, 1,300 feet west and 2,200 feet south of the northeast corner of sec. 18, T. 19 N., R. 10 E.

Oi—2 inches to 0; undecomposed needles, leaves, and twigs.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; many very fine irregular pores; about 30 percent pebbles; strongly acid; abrupt smooth boundary.

A2—3 to 6 inches; dark brown (10YR 4/3) gravelly sandy loam, brown (10YR 5/3) dry; weak fine

granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine, common medium, and few coarse roots; many very fine irregular pores; about 30 percent pebbles; strongly acid; abrupt smooth boundary.

C1—6 to 15 inches; dark brown (7.5YR 4/4) very gravelly loamy sand, brown (7.5YR 5/4) dry; single grain; soft, very friable, nonsticky and nonplastic; many fine, common very fine and medium, and few coarse roots; many fine irregular pores; about 40 percent pebbles and 5 percent cobbles; strongly acid; clear smooth boundary.

C2—15 to 21 inches; dark brown (10YR 4/3) very gravelly loamy sand, brown (10YR 5/3) dry; single grain; soft, very friable, nonsticky and nonplastic; many fine, common very fine and medium, and few coarse roots; many fine irregular pores; about 40 percent pebbles and 5 percent cobbles; moderately acid; clear smooth boundary.

C3—21 to 28 inches; brown (10YR 5/3) extremely gravelly sandy loam, light yellowish brown (10YR 6/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many fine irregular pores; about 45 percent pebbles and 15 percent cobbles; moderately acid; clear smooth boundary.

C4—28 to 60 inches; brown (10YR 5/3) extremely gravelly sandy clay loam, light yellowish brown (10YR 6/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; few fine, medium, and coarse roots; many fine irregular pores; about 45 percent pebbles and 15 percent cobbles; moderately acid.

The depth to stratified, loamy or sandy, gravelly material is 15 to 50 inches. The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 3 to 5 when dry, and chroma of 2 or 3 when moist and dry. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 3 to 6 when moist and dry. It is stratified with extremely gravelly sand in some pedons.

Vailton Series

The Vailton series consists of deep, well drained soils formed in a mixture of volcanic ash and colluvium and residuum derived from siltstone and sandstone. These soils are on mountain back slopes. Slopes are 8 to 65 percent. Elevation is 1,700 to 2,800 feet. The average annual precipitation is 70 to 90 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 160 to 180 days.

These soils are medial, frigid Andic Haplumbrepts.

Typical pedon of Vailton silt loam, 8 to 30 percent slopes, in Pierce County, about 9 miles south of Fairfax, near Niesson Creek, 3,100 feet west and 3,000 feet south of the northeast corner of sec. 15, T. 16 N., R. 6 E.

Oi—3 to 2 inches; undecomposed needles, leaves, and twigs.

Oa—2 inches to 0; black (10YR 2/1), decomposed organic mat.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; about 2 percent pebbles; strongly acid; clear smooth boundary.

A2—2 to 10 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; about 2 percent pebbles; strongly acid; clear wavy boundary.

AB—10 to 15 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium and coarse roots; many very fine irregular pores; about 10 percent pebbles; strongly acid; abrupt wavy boundary.

Bw1—15 to 27 inches; dark yellowish brown (10YR 4/4) silt loam, very pale brown (10YR 7/4) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium and few coarse roots; many very fine irregular pores; about 10 percent pebbles; moderately acid; clear smooth boundary.

Bw2—27 to 37 inches; dark yellowish brown (10YR 4/4) silt loam, very pale brown (10YR 7/4) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and plastic; weakly smeary; many very fine irregular pores; about 10 percent pebbles; moderately acid; clear smooth boundary.

BC—37 to 43 inches; dark brown (7.5YR 4/4) silty clay loam, pink (7.5YR 7/4) dry; moderate medium angular blocky structure; hard, firm, sticky and plastic; weakly smeary; common very fine irregular pores; about 10 percent pebbles; strongly acid; abrupt smooth boundary.

Cr—43 inches; dark grayish brown (2.5Y 4/2), weathered sandstone.

The depth to weathered sandstone or siltstone is 40 to 60 inches. The content of soft rock fragments in the particle-size control section ranges from 10 to 25 percent.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and dry. The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 6 or 7 when dry, and chroma of 3 or 4 when moist and dry. It is silt loam or silty clay loam.

Voight Series

The Voight series consists of very deep, well drained soils formed in residuum and colluvium derived from extrusive igneous rocks. These soils are on mountain back slopes. Slopes are 6 to 65 percent. Elevation is 1,700 to 2,800 feet. The average annual precipitation is 60 to 90 inches, and the mean annual air temperature is about 43 degrees F. The frost-free period is 135 to 155 days.

These soils are fine-loamy, mixed Eutric Glossoboralfs.

Typical pedon of Voight silt loam, 6 to 15 percent slopes, in Pierce County, about 4 miles southeast of Ohop, 50 feet northeast of Weyerhaeuser Road 1611A, about 0.2 mile from its intersection with Koll Road, 200 feet east and 550 feet south of the northwest corner of sec. 10, T. 16 N., R. 5 E.

Oi—10 to 7 inches; needles, twigs, leaves, and bark.

Oa—7 inches to 0; decomposed organic material and rotted wood; many very fine, fine, medium, and coarse roots.

A—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and common medium and coarse roots; many fine and very fine tubular pores; about 5 percent angular pebbles; strongly acid; clear smooth boundary.

Bt1—11 to 27 inches; brown (7.5YR 4/4) silty clay loam, light brown (7.5YR 6/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine and few medium and coarse roots; many fine and very fine pores; few thin, patchy clay films on faces of peds and in pores; about 5 percent angular pebbles; strongly acid; gradual smooth boundary.

Bt2—27 to 43 inches; brown (7.5YR 4/4) silty clay loam, light brown (7.5YR 6/4) dry; weak medium

subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; common moderately thick, clay films in pores; about 5 percent angular pebbles; strongly acid; clear smooth boundary.

Bt3—43 to 58 inches; reddish brown (5YR 4/4) silty clay loam, reddish brown (5YR 5/4) dry; weak medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; common moderately thick clay films in pores; about 5 percent angular pebbles; strongly acid; clear smooth boundary.

C—58 to 65 inches; dark reddish brown (5YR 3/4) and brown (7.5YR 4/2) silt loam, reddish brown (5YR 4/4) and light brownish gray (10YR 6/2) dry; massive; exhibits rock structure prior to rubbing; hard, firm, slightly sticky and plastic; few very fine tubular pores; about 5 percent angular pebbles; moderately acid.

Reaction is strongly acid or moderately acid throughout the profile.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and chroma of 2 or 3 when moist and dry.

The Bt1 and Bt2 horizons have hue of 7.5YR or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 3 to 6 when moist and dry. They are silty clay loam, clay loam, or gravelly silty clay loam.

The Bt3 horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 3 to 6 when moist and dry. It is silty clay loam, gravelly silty clay loam, loam, gravelly loam, silt loam, or gravelly silt loam. The content of coarse fragments is 0 to 35 percent by volume.

The C horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist and dry. It is silt loam, gravelly silt loam, loam, or gravelly loam. The content of coarse fragments is 0 to 35 percent by volume.

Welcome Series

The Welcome series consists of deep, well drained soils formed in volcanic ash, colluvium, and slope alluvium derived from sandstone and modified by glacial till. These soils are on mountain back slopes. Slopes are 0 to 65 percent. Elevation is 1,800 to 2,500 feet. The average annual precipitation is 60 to 90 inches, and the mean annual air temperature is about 44

degrees F. The frost-free period is 150 to 170 days.

These soils are coarse-loamy, mixed, frigid Typic Haplorthods.

Typical pedon of Welcome loam, 0 to 30 percent slopes, in King County, about 5 miles southeast of Issaquah, 800 feet west and 1,200 feet north of the southeast corner of sec. 7, T. 23 N., R. 7 E.

Oi—1 inch to 0; undecomposed needles and twigs.

A—0 to 2 inches; very dark brown (10YR 2/2) loam, dark brown (7.5YR 3/2) dry; weak medium granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; many very fine irregular pores; about 5 percent hard pebbles; strongly acid; abrupt wavy boundary.

Bs1—2 to 5 inches; dark brown (7.5YR 4/4) loam, yellowish brown (10YR 5/4) dry; strong medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; many very fine irregular pores; about 10 percent hard pebbles and 5 percent weathered pebbles; NaF pH 12.0; moderately acid; clear smooth boundary.

Bs2—5 to 12 inches; strong brown (7.5YR 4/6) silt loam, strong brown (7.5YR 5/6) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium roots; many very fine irregular pores; about 10 percent hard pebbles and 5 percent weathered pebbles; NaF pH 12.0; moderately acid; clear smooth boundary.

Bs3—12 to 25 inches; dark yellowish brown (10YR 4/6) gravelly loam, yellowish brown (10YR 5/4) dry; strong medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; weakly smeary; few fine and medium roots; many very fine irregular pores; about 15 percent hard pebbles and 10 percent weathered pebbles; NaF pH 12.0; moderately acid; clear smooth boundary.

BC—25 to 35 inches; light olive brown (2.5Y 5/4) gravelly loam, pale yellow (2.5Y 7/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; few fine and medium roots; about 15 percent hard pebbles and 15 percent weathered pebbles; NaF pH 11.5; moderately acid; clear smooth boundary.

C—35 to 53 inches; light olive brown (2.5Y 5/4) fine sandy loam, pale yellow (2.5Y 7/4) and brownish yellow (10YR 6/6) dry; massive; slightly hard, friable, nonsticky and nonplastic; about 20 percent weathered pebbles; NaF pH 10.5; moderately acid; clear smooth boundary.

Cr—53 inches; light olive brown (2.5Y 5/4), soft sandstone that crushes to loamy sand, pale yellow (2.5Y 7/4) dry; can be cut by a spade with difficulty.

The depth to weathered, soft sandstone ranges from 40 to 60 inches. The particle-size control section has 0 to 15 percent hard pebbles and 10 to 30 percent weathered pebbles.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 4 to 6 when moist and dry. It is loam, silt loam, or gravelly loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 4 to 6 when moist and dry. It is fine sandy loam, sandy loam, or loamy sand.

Wilkeson Series

The Wilkeson series consists of very deep, well drained soils formed in residuum and colluvium derived from andesite and basalt. These soils are on foothills and mountains. Slopes are 6 to 65 percent. Elevation is 600 to 1,800 feet. The average annual precipitation is 50 to 70 inches, and the mean annual air temperature is about 47 degrees F. The frost-free period is 140 to 160 days.

These soils are fine-loamy, mixed, mesic Ultic Haploxeralfs.

Typical pedon of Wilkeson gravelly silt loam, 30 to 45 percent slopes, in Pierce County, about 0.5 mile east of Ohop, 1,700 feet east and 1,600 feet south of the northwest corner of sec. 21, T. 17 N., R. 5 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly silt loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine pores; about 5 percent shotlike aggregates and 30 percent angular pebbles; moderately acid; abrupt smooth boundary.

A2—4 to 10 inches; dark brown (10YR 3/3) very gravelly loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine, medium, and coarse roots; many very fine and fine pores; about 5 percent shotlike aggregates and 45 percent angular pebbles; strongly acid; diffuse wavy boundary.

BA—10 to 18 inches; brown (10YR 4/3) gravelly silt loam, brown (10YR 5/3) dry; weak fine subangular

blocky structure; hard, firm, sticky and plastic; many fine, medium, and coarse roots; many very fine and fine pores; about 20 percent shotlike aggregates and angular pebbles; strongly acid; clear wavy boundary.

Bt1—18 to 27 inches; dark yellowish brown (10YR 4/4) gravelly loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many fine, medium, and coarse roots; common very fine and fine pores; thin, patchy clay films in pores; about 5 percent shotlike aggregates and 30 percent angular pebbles; strongly acid; diffuse wavy boundary.

Bt2—27 to 36 inches; yellowish brown (10YR 5/4) loam, light yellowish brown (10YR 6/4) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few fine and coarse roots; common very fine and fine pores; moderately thick, patchy clay films in fine pores; about 5 percent angular pebbles; moderately acid; gradual wavy boundary.

Bt3—36 to 49 inches; dark yellowish brown (10YR 4/4) loam, yellowish brown (10YR 5/6), light yellowish brown (10YR 6/4), and pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common very fine and fine pores; thick, patchy clay films on faces of peds and in very fine pores; about 10 percent angular pebbles; moderately acid; diffuse wavy boundary.

BCt—49 to 60 inches; yellowish brown (10YR 5/4) gravelly loam, light reddish brown (2.5YR 6/4), very pale brown (10YR 7/3), light yellowish brown (10YR 6/4), and brownish yellow (10YR 6/6) dry; massive; hard, firm, sticky and plastic; few fine roots; few very fine and fine pores; thick, continuous clay films in very fine pores; about 25 percent angular pebbles; moderately acid.

The particle-size control section ranges from 18 to 35 percent clay and from 15 to 35 percent coarse fragments.

The A horizon has chroma of 2 or 3 when moist and dry. Reaction is strongly acid or moderately acid.

The Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 3 to 6 when moist and dry. It is loam, gravelly silt loam, gravelly loam, gravelly clay loam, or gravelly silty clay loam.

The BCt horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 5 or 6 when moist and 5 to 8 when dry, and chroma of 3 to 6 when dry. It is loam, gravelly loam, or gravelly clay loam. Reaction is strongly acid to slightly acid.

Winston Series

The Winston series consists of very deep, well drained soils formed in volcanic ash and glacial outwash. These soils are on terraces and escarpments. Slopes are 0 to 30 percent. Elevation is 1,000 to 1,500 feet. The average annual precipitation is 50 to 70 inches, and the mean annual air temperature is about 48 degrees F. The frost-free period is 150 to 170 days.

These soils are coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplorthods.

Typical pedon of Winston loam, 0 to 8 percent slopes, in King County, at the north edge of the Howard Hanson Reservoir, 650 feet north and 800 feet west of the southeast corner of sec. 22, T. 21 N., R. 8 E.

Oi—1 inch to 0; undecomposed needles, leaves, and twigs.

A—0 to 5 inches; dark brown (7.5YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium roots; many very fine irregular pores; about 5 percent pebbles; moderately acid; clear smooth boundary.

Bs1—5 to 11 inches; strong brown (7.5YR 4/6) loam, yellowish brown (10YR 5/6) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium and coarse roots; many very fine irregular pores; about 10 percent pebbles; moderately acid; clear smooth boundary.

Bs2—11 to 21 inches; dark brown (7.5YR 3/4) gravelly loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; common very fine and fine roots; many very fine irregular pores; about 15 percent pebbles; slightly acid; clear smooth boundary.

Bs3—21 to 34 inches; dark brown (7.5YR 4/4) gravelly fine sandy loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; common very fine and fine roots; many very fine irregular pores; about 20 percent pebbles; slightly acid; abrupt wavy boundary.

2C—34 to 60 inches; very dark grayish brown (10YR 3/2) extremely gravelly sand, grayish brown (10YR 5/2) dry; single grain; loose; many fine irregular pores; about 60 percent pebbles and 5 percent cobbles; neutral.

The thickness of the solum and depth to the 2C horizon range from 14 to 38 inches. The content of rock

fragments ranges from 15 to 35 percent in the upper part of the particle-size control section and from 35 to 70 percent in the lower part.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 2 or 3 when moist and dry.

The Bs horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 4 to 6 when moist and dry. It is loam, gravelly loam, or gravelly fine sandy loam.

The 2C horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist and 4 to 7 when dry, and chroma of 1 to 4 when moist and dry. It is very gravelly loamy sand, very gravelly sand, extremely gravelly loamy sand, or extremely gravelly sand.

Woodinville Series

The Woodinville series consists of very deep, poorly drained soils formed in alluvium stratified with decomposed organic material. These soils are on flood plains. Slopes are 0 to 2 percent. Elevation is 50 to 120 feet. The average annual precipitation is 40 to 50 inches, and the mean annual air temperature is about 50 degrees F. The frost-free period is 180 to 200 days.

These soils are fine-silty, mixed, nonacid, mesic Aeric Fluvaquents.

Typical pedon of Woodinville silt loam, 0 to 2 percent slopes, in King County, about 1 mile northeast of Carnation, 2,500 feet north and 750 feet east of the southwest corner of sec. 10, T. 25 N., R. 7 E.

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; very hard, friable, sticky and plastic; many very fine and fine roots; many very fine irregular pores; strongly acid; abrupt smooth boundary.

Cg1—7 to 12 inches; light olive gray (5Y 6/2) silt loam, white (5Y 8/1) dry; massive; very hard, friable, sticky and plastic; common very fine and fine roots; many very fine irregular pores; strongly acid; clear smooth boundary.

Cg2—12 to 15 inches; olive gray (5Y 5/2) silt loam, light gray (5Y 7/2) dry; common coarse prominent strong brown (7.5YR 5/8) and brownish yellow (10YR 6/6) mottles, strong brown (7.5YR 5/8) and yellow (10YR 7/6) dry; massive; very hard, friable, sticky and plastic; common very fine and fine roots; many very fine irregular pores; strongly acid; abrupt smooth boundary.

Oa&Cg1—15 to 19 inches; stratified dark brown (10YR 3/3) muck (70 percent) and dark brown (10YR 4/3) silt loam (30 percent), brown (10YR 5/3) and light gray (10YR 7/2) dry; massive; hard, friable, sticky

and plastic; common fine roots; many very fine irregular pores; moderately acid; clear smooth boundary.

Oa&Cg2—19 to 26 inches; stratified dark brown (7.5YR 3/2) muck (60 percent) and dark brown (10YR 3/3) and grayish brown (10YR 5/2) silt loam (40 percent), dark brown (7.5YR 3/4), very pale brown (10YR 7/3), and light gray (10YR 7/2) dry; massive; hard, friable, sticky and plastic; many very fine irregular pores; moderately acid; clear smooth boundary.

Cg&Oa—26 to 42 inches; stratified grayish brown (10YR 5/2) silt loam (60 percent) and dark brown (10YR 4/3) muck (40 percent), white (2.5Y 8/2) and brown (10YR 5/3) dry; massive; hard, friable, sticky and plastic; many very fine irregular pores; moderately acid; abrupt smooth boundary.

C'g—42 to 53 inches; grayish brown (2.5Y 5/2) silt loam, white (2.5Y 8/2) dry; few fine prominent brownish yellow (10YR 6/6) mottles, yellow (10YR 7/6) dry; massive; hard, friable, sticky and plastic; many very fine irregular pores; strongly acid; abrupt smooth boundary.

O'a&C'g—53 to 60 inches; stratified very dark brown (10YR 2/2) muck (50 percent) and grayish brown (10YR 5/2) silt loam (50 percent), very dark grayish brown (10YR 3/2) and light gray (10YR 7/2) dry; massive; extremely hard, friable, sticky and plastic; many fine irregular pores; strongly acid.

The mineral material above the stratified, mineral and organic material is 20 to 40 inches thick.

The Ap horizon has hue of 10YR or 2.5Y, value of 2 to 4 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist and dry.

The Cg horizon has hue of 2.5Y or 5Y, value of 5 or 6 when moist and 7 or 8 when dry, and chroma of 1 or 2 when moist and dry. It is silt loam or silty clay loam.

The Cg and Oa layers below the Cg horizon occur as strata of mineral and organic material. The Cg material has hue of 7.5YR to 2.5YR, value of 3 to 5 when moist and 6 to 8 when dry, and chroma of 2 to 4 when moist and dry. The Oa material has value of 2 to 4 when moist and 3 to 5 when dry.

Zynbar Series

The Zynbar series consists of very deep and deep, well drained soils formed in a mixture of volcanic ash, colluvium derived from basic igneous rocks, and glacial till. These soils are on mountain back slopes. Slopes are 0 to 65 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is 70 to 100 inches, and the mean annual air temperature is about 44

degrees F. The frost-free period is 140 to 160 days.

These soils are medial, frigid Entic Dystrandepts.

Typical pedon of Zynbar loam, 6 to 30 percent slopes, in Pierce County, about 4 miles southeast of Ohop, 1,800 feet west and 900 feet south of the northeast corner of sec. 35, T. 17 N., R. 5 E.

Oi—2 inches to 0.5 inch; undecomposed needles, twigs, and bark.

Oa—0.5 inch to 0; decomposed organic mat.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, dark brown (10YR 4/3) dry; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; moderately acid; clear smooth boundary.

A2—5 to 10 inches; dark brown (10YR 4/3) loam, yellowish brown (10YR 5/4) dry; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; moderately acid; clear smooth boundary.

Bw1—10 to 18 inches; dark yellowish brown (10YR 4/4) loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine, fine, and medium and common coarse roots; many very fine irregular pores; moderately acid; clear smooth boundary.

Bw2—18 to 28 inches; dark yellowish brown (10YR 4/4) gravelly silt loam, very pale brown (10YR 7/4) dry; moderate medium subangular blocky structure;

slightly hard, firm, slightly sticky and slightly plastic; weakly smeary; common very fine, fine, and medium roots; many very fine irregular pores; about 15 percent pebbles; slightly acid; clear smooth boundary.

Bw3—28 to 41 inches; dark yellowish brown (10YR 4/6) gravelly silt loam, very pale brown (10YR 7/4) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; weakly smeary; common very fine, fine, and medium roots; many very fine irregular pores; about 20 percent pebbles; slightly acid; clear smooth boundary.

C—41 to 60 inches; dark yellowish brown (10YR 4/6) silt loam, very pale brown (10YR 7/4) dry; weak medium angular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; weakly smeary; common very fine irregular pores; slightly acid.

The thickness of the solum ranges from 40 to more than 60 inches. The content of rock fragments in the particle-size control section ranges from 15 to 25 percent.

The A horizon has value of 2 to 4 when moist and 4 to 6 when dry and chroma of 2 to 4 when moist and dry.

The Bw horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 3 to 6 when moist and dry. It is loam, silt loam, gravelly loam, or gravelly silt loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 4 to 6 when moist and dry. It is loam, silt loam, gravelly loam, or gravelly silt loam.

Formation of the Soils

By James A. Mitchell, Soil Conservation Service.

Soil is a dynamic, natural, three-dimensional body formed in mineral and organic material on the surface of the Earth. It provides air, water, root anchorage, and sustenance for plants. It is a fundamental part of the ecosystem.

Soil forms through the integrated effects of physical, biological, and chemical weathering of geological material acting over time. It differs in appearance, productivity, and management requirements in different localities and even within short distances. Individual soils are characterized by a vertical sequence of layers, or horizons, which vary in such properties as color, texture, acidity, and amount of rock fragments. Horizons are continually forming and evolving in response to environmental factors. The characteristics and properties of the soil at any given place are determined by the interaction of the following five factors: the physical, chemical, and mineralogical composition of the parent material; the climatic conditions acting on the parent material during the evolution of the soil; the topography, or relief, of the landscape; the plant and animal life in and on the soil; and the age of the soil, or the length of time that the climate, topography, and biota have acted on the parent material.

The five factors are interdependent. The combined action of these forces results in soil formation, although one or two of the factors may predominate in a given area. Climate and biota, particularly vegetation, are the active forces of soil formation. A particular set of soil-forming factors gives rise to a unique soil profile. As any one factor changes, so does the soil.

In the following sections, the effects on soil formation of climate, biological forces, and parent material are described separately. The effects of topography and time, or age, are described under the heading "Geomorphology."

Climate

Climate greatly influences soil formation. To a large degree, it controls the chemical and physical reactions taking place in the soil. Moisture and temperature are especially important.

Water dissolves soluble material in soil and transports material from one part of the soil to another. The transported material includes particulate and colloidal material, such as silt and clay, and substances fully dissolved into solution. Water is necessary for the growth of plants and other organisms, which contribute organic matter to the soil and affect the mobility and formation of chemical products.

Temperature affects the rate of chemical reactions, the rate of the physical breakdown of soil material caused by the freezing of water, and the duration of snow cover. Freezing and thawing of water causes expansion and contraction, which influence the movement of soil particles and rock fragments in the soil. The duration of snow cover helps to determine the amount of effective precipitation and the soil temperature.

Because the survey area is on the west side of the Cascade Mountain Crest, the climate of the area has a strong marine influence from the Pacific Ocean. Because the elevation ranges from 25 to 6,278 feet above sea level, however, both the amount and form of precipitation and the temperature vary considerably.

The soils in most parts of the survey area have a udic moisture regime. This determination is based on the fact that most of the total annual precipitation falls between October and May and that the total annual precipitation exceeds 70 inches. Because most of the precipitation at the higher elevations is in the form of snow, however, the moisture may not enter the soil or may not be retained by the coarse textured soils for very long after the snowpack melts. The combination of these factors can result in a significant reduction in effective precipitation, particularly on south-facing slopes. The condition caused by the reduction in effective precipitation in the soils at the higher elevations approximates a xeric moisture regime.

Besides the indicated udic regime, two other soil moisture regimes are encountered in the survey area. Soils in the aquic moisture regime are on the poorly drained bottom land, in river valleys along the western border of the survey area, and in depressions in areas on uplands where a seasonal high water table keeps the soils saturated for prolonged periods. Soils in the

xeric moisture regime are in the western part of the survey area, where the annual precipitation is less than about 70 inches. The conditions in this area approximate those in the Puget Trough section, which is one of the three major physiographic and geologic divisions in the survey area described under the heading "Geomorphology."

Definitions of the three soil moisture regimes are provided in the "Glossary." The xeric moisture regime is that typified in Mediterranean climates. It provides less moisture to plants during the growing season than a udic regime.

The considerable variation in elevation within the survey area results in three soil temperature regimes. These regimes are mesic, frigid, and cryic. They are zoned vertically by increasing elevation and by latitude. The boundaries between regimes decrease in elevation from south to north. The boundary between the frigid and cryic regimes is indicated by the presence of Pacific silver fir (*Abies amabilis*). Soil temperatures reported in this section are the result of a 2-year, systematic measurement effort made during the course of this survey.

Five major moisture and temperature zones are in the survey area. In the following paragraphs, these climatic zones are briefly described.

Climate zone one has an annual precipitation of less than 50 inches, occurring predominantly in the form of rain from October through May. The average annual soil temperature is 49 or 50 degrees F, which is in the mesic temperature regime. The annual distribution and quantity of precipitation indicate a xeric soil moisture regime. This is the least extensive climate zone in the survey area. It occurs only along the western border of the area and in the major river valleys.

Most of the soils in zone one, such as Alderwood and Beausite soils, have a light colored surface layer (ochric epipedon) and are Haplorthods. Some are Xerolls, Xerumbrepts, or Xerofluvents. The soils generally do not have a spodic horizon. Some, however, have a weakly developed one. Development may be weak and uncommon because the vegetation that readily generates sufficient quantities of mobile fluvic acids upon decomposition is scarce.

A spodic horizon is a subsurface layer in which active amorphous materials, made up of organic material and aluminum and in places iron, have precipitated. It is a diagnostic characteristic of Spodosols. Fluvic acid, which is capable of complexing metal ions in the eluvial soil layer and transporting the required precipitate to the spodic horizon (25), is generated by the decomposition of vegetation and organic litter on the surface. The spodic horizon is more

strongly expressed under some vegetative species than others (31).

Climate zone two has an annual precipitation of 50 to 70 inches. It has a mesic soil temperature regime. Most of the precipitation occurs in the form of rain from October through May. Snow is infrequent.

Generally, the soils in zone two have a high degree of forest productivity. Even the coarse textured soils in this zone have a higher degree of productivity than that of similar soils in zone one. Because they receive a large amount of precipitation, have unrestricted drainage, and are in upland positions, most of the soils in zone two have a low base saturation. Some areas of zone two receive less precipitation than the rest of the zone. The soils in these areas are in the xeric moisture regime. Large variations in moisture content occur in these soils. They allow for the movement of colloidal clay and the subsequent development of an argillic horizon, which is an illuvial subsoil in which clay has accumulated to a significant extent. Scamman and Mashel are examples of soils that have an argillic horizon. They are Alfisols. Some soils in this zone have illuvial clay in the subsoil, but the amount of clay is not sufficient for the subsoil to qualify as an argillic horizon.

Along the upper limit of zone two and the lower limit of Zone three is a small linear area, trending north to south, that receives about 70 inches of rainfall per year. It has an average annual soil temperature of about 47 degrees F, which is in the mesic temperature regime. It has the highest degree of forest productivity in the survey area. This high productivity is not solely the result of climate; many of the soils in this band have a high available water capacity and a high nutrient-holding capacity. The vegetation in this band may be characterized as the western hemlock/western swordfern (*Tsuga heterophylla*/*Polystichum munitum*) plant association (15).

Climate zone three has an average annual precipitation of 70 to 130 inches. The average annual soil temperature is 43 to 47 degrees F, which is in the frigid temperature regime. This zone frequently receives precipitation in the form of snow. The snow remains on the ground for only a short period, and a snowpack does not develop. The upper elevation of this zone generally is about 2,600 feet, but it varies with latitude, aspect, and local climatic conditions.

In winter low soil temperatures reduce the rate of biological and chemical activity. Because of low air temperatures and the lack of continuous snow cover, freezing is common in the upper few inches of the soils.

Climatic zone three supports much more western hemlock (*Tsuga heterophylla*) than zone one. Many of the soils exhibit features of spodic horizon development.

Although they generally do not meet the chemical criteria for a spodic horizon, they are classified as Spodosols because they have cracked coatings on sand grains and have silt-sized and larger pellets. Examples of such soils in this zone are Elwell, Littlejohn, Oakes, and Pitcher soils.

Because of the content of clay in the soils and the amount of time that the soils have been subject to weathering, Christoff and Voight are the only soils in this zone that have an argillic horizon. An argillic horizon requires a long time to form in mobile clays. The texture of some of the soils in this zone limits the downward movement of water through the profile. This restriction results in a zone in which colloidal clay is precipitated when the soil dries in summer. Most of the soils in this zone, however, are coarse textured and have unrestricted drainage. In Voight soils albic material (leached mineral soil) tongues into the argillic horizon. This condition is consistent with features common to the other soils in this climate zone.

The cool temperatures of this zone have slowed the decomposition and incorporation of organic matter in the surface layer of some of the soils, producing a light colored surface horizon (ochric epipedon). Examples of soils having an ochric epipedon are Elwell, Littlejohn, and Pitcher soils. Precipitation has leached bases from the surface layer of other soils, producing a dark surface layer (umbric epipedon). Examples of soils having an umbric epipedon are Dobbs, Jonas, and Pheeney soils.

Climate zone four has an average annual precipitation of 75 to 100 inches, dominantly in the form of snow. The average annual soil temperature is 43 to 46 degrees F, and the mean soil temperature in summer is less than 59 degrees F. The soils in this zone are in the cryic temperature regime. The average annual snowfall is 300 to 450 inches. Winter snowpacks are as deep as 9 feet and last through April at the upper elevations. This zone approximates the Pacific silver fir (*Abies amabilis*) major vegetative zone.

The soils in zone four are dominantly Haplic Cryohumods and Typic Cryorthods, which have a leached surface layer (albic horizon) and an accumulation of organic matter, iron, and aluminum in the subsoil. Cattcreek and Crinker soils are examples of Typic Cryorthods. The soils that have more organic carbon than iron in the subsoil formed in ashy or sandy material. Index and Klapatche soils are examples of Haplic Cryohumods. The Typic Cryorthods and the Haplic Cryohumods have a relatively low bulk density, a low base saturation, and a high available water capacity relative to clay content.

Climate zone five approximates the mountain

hemlock (*Tsuga mertensiana*) major vegetative zone. At the highest elevations subalpine fir (*Abies lasiocarpa*) is common. This zone receives as much as 130 inches of precipitation, dominantly in the form of snow. The average annual soil temperature is 38 to 42 degrees F, and the mean soil temperature in summer is about 45 degrees F. The soils in this zone are in the cryic temperature regime. The soil and air temperatures of this zone are significantly colder than those of climate zone four. Snowfall accumulates in deep snowpacks that last through May. Because of the pattern of winter storms in the western Cascades, many of the soils in this zone receive less precipitation than those in zone four. Many of the storms approach at a low level or elevation and thus commonly deposit more moisture at the lower elevations. The amount of effective precipitation is significantly reduced by evaporation, sublimation, and runoff during snowmelt.

Because of the accumulation of organic matter in a spodic horizon, the soils in zone five are dominantly Typic Cryohumods and Humic Cryorthods. Typically, they have a thick organic mat on the surface. The mat is almost hydrophobic when dry. These features are associated with cold temperatures, which slow biological activity and organic matter degradation.

Chinkmin and Kindy are examples of soils in this zone that exhibit the development of a cemented layer in the spodic horizon. This cemented layer is termed *ortstein*. It is the result of the precipitation of illuvial sesquioxides and organic matter. This precipitation may occur in the spodic horizon because percolating water is insufficient to carry colloids and solutes farther into the soil profile (5). The climate and the thick organic mat on the surface may be responsible for the insufficiency in the Chinkmin and Kindy soils. These soils also have compacted glacial till at a moderate depth, which contributes to the inhibition of deep percolation and to the precipitation of sesquioxides.

Climate zone five has significant areas of alpine meadow covered by heath shrub or by lush herbaceous vegetation. The Treen soils are an example of soils in these areas. Because of the herbaceous vegetation, the very cold climate, and the extensive periods of deep snowpack, they are shallow and have a dark surface layer. They are Medial Lithic Cryandepts.

Biological Forces

Vegetation, burrowing animals, insects, earthworms, bacteria, and fungi are important in the formation of soils. Plants draw moisture and nutrients from the soil and improve aeration, soil structure, and permeability. They intercept rainfall and mitigate its impact. Roots

help to control runoff and erosion by stabilizing the soil. The remains of dead plants replenish the content of organic matter in the soil.

Living organisms significantly affect soil properties. Rodents, earthworms, and various other animals and insects assist in the decomposition of organic substances and mix the soil. Decay organisms are involved in the synthesis of humus. Some micro-organisms supply nitrogen as a nutrient for plants, modifying the pattern and extent of organic matter accumulation in the soil (17). Because most of the survey area is forested, mycorrhizal fungi are especially significant. Nearly all forest plants have evolved with a strong dependence on this fungi for extracting nutrients from the soil (28).

Some biological forces have a destructive effect on soil formation. Extensive burrowing by colonies of mountain beaver can destroy or mix soil layers that have taken many years to develop. The destruction or mixing of soil layers also can occur in areas where large trees are windthrown.

In areas where the growth of aerobic soil fauna is inhibited by wet and cold conditions, organic matter can accumulate. Lemolo, Nimue, and Haywire are examples of soils that are wet and cold and have a high organic matter content.

Mukilteo, Seattle, Shalcar, and Tukwila are examples of organic soils that formed in the accumulated remains of plants, such as sedges, rushes, and mosses, in bogs. These soils are saturated or nearly saturated most of the year. The saturation substantially slows the biological processes that break down organic material.

In the warmer areas at the lower elevations, plant material is decomposed by various fauna and incorporated into the mineral surface layer. This incorporation of organic matter results in a dark surface layer (mollic or umbric epipedon). This dark surface layer is evident in soils that are in areas where the original forest vegetation has been converted to pasture. Nooksack soils are an example.

Grasses and herbaceous plants are more easily decomposed than woody plants. Soils that formed under herbaceous vegetation have a dark mineral surface layer even in the colder zones where biological activity has been slowed. Treen soils are an example.

The soils at the lower elevations are in the western hemlock (*Tsuga heterophylla*) major forest zone (15). Large areas of this zone, particularly at the lowest elevations, are dominated by Douglas fir (*Pseudotsuga menziesii*). The forest floor in this zone typically has a "mull" layer of humus on the surface of the mineral soil. This layer is characteristic in areas where decomposition is rapid and where moisture and

temperature favor rapid biological activity in the soil (35). At the higher and cooler elevations in this zone, where western hemlock becomes the dominate tree species, a "duff mull" layer of humus is common. This layer tends to favor the development of Spodosols, such as Kaleetan and Melakwa soils. This tendency results from the more intense, shorter duration microfaunal activity in the "mor" portion of the "duff mull" layer.

The soils at the higher elevations are in the Pacific silver fir (*Abies amabilis*) major forest zone. The forest floor in this zone typically has a "mor" layer of humus on the surface of the mineral soil. This layer favors the podzolization process and the development of Spodosols, such as Cattcreek, Index, and Playco soils.

The soils at the highest elevations are in the mountain hemlock (*Tsuga mertensiana*) major forest zone. In this zone the "mor" layer of humus is thick. Cryohumods and Humic Cryorthods, such as Haywire, Serene, and Ethania soils, are typical.

Parent Material

Parent material is "the state of the soil system at time zero of soil formation" (19). It is the material in which a soil forms. Examples are material weathered from rocks, plant material deposited in bogs, and alluvium. Parent material influences many soil properties. Generally, the younger the soil, the more influential the parent material (5).

The survey area lies within two major physiographic and geologic sections. These are the Puget Trough section and the Northern Cascade Mountains section, which is divided into northern and southern subsections. Different types of parent material are in each of these areas. In addition to the materials dominant in each area, plant remains in bogs, glacial till, alluvium, proglacial lacustrine deposits, laharic deposits, and eolian volcanic ash deposits of Pleistocene age are throughout the survey area. The eolian ash was extensively deposited in the area. It influences the majority of the soils. Also, it is the primary parent material of some soils, such as Zynbar and Cattcreek soils.

The western part of the survey area is within the Puget Trough section. The influence of the parent material in this section extends to an elevation of approximately 1,600 feet. This section is the result of the invasion from the north of a lobe of the Cordilleran Icecap. The glacial advance and subsequent retreat occurred at least four times during the Pleistocene Epoch. The recession of the last of these glaciations began about 15,000 years ago. The topography and

geology now in evidence in the lowlands of the Puget Sound are almost exclusively the result of these glaciations (14, 21).

The parent material in the Puget Trough section is glacial drift and related deposits. Soils that formed in recessional outwash deposits, such as Barneston soils, are coarse textured and somewhat excessively drained. The sequence of their layers varies greatly. Soils that formed in glacial till, such as Alderwood and Tokul soils, commonly have a layer of hard ortstein within a depth of 3 feet and are moderately well drained. The layer of ortstein restricts root development and the downward movement of water. The top of this layer marks the boundary between intact lodgment till and either ablation material or lodgment till that has been loosened by tree roots. In Tokul soils the material above the lodgment till is strongly influenced by volcanic ash deposits that impart medial properties, such as a high available water capacity.

Alderwood and Tokul soils formed in till of the Fraser glaciation, which is the most recent glaciation. Mashel soils formed in till of one of the much older glaciations. This till has been extensively weathered, and a consolidated contact is not evident in the soil profile. These soils are finer textured throughout than the soils that formed in the till of more recent glaciations. Nargar, Neilton, and Lynnwood are examples of soils that formed in glacial outwash deposits. They are sandy throughout.

The fine textured Scamman soils, which are in the southwestern part of the survey area, formed mostly in fine textured, proglacial lake sediments. The Cordilleran Ice Sheet produced a very efficient dam across the mountain valleys, impounding the alpine drainageways (23) and creating a lake in each valley, including the valleys of the Skykomish and Snoqualmie Rivers. The moderately coarse textured Klaus soils formed in deltaic deposits in areas where tremendous deltas were built up at the mouth of each valley. These deposits are still evident. They consist of very coarse beds of gravel and sand, which dip upvalley. Pastik and Rober soils formed in remnant deposits of fine grained sediments that were deposited in the lakes farther up the major river valleys. Postglacial erosion has removed most of these fine sediments.

The survey area is divided between the southern and northern parts of the Northern Cascade Mountains section. The division between these parts is a boundary extending from east to west through Snoqualmie Pass. North of this boundary the mountains are made up of crystalline, intrusive granitics and a full spectrum of metamorphic rock types, primarily of Mesozoic age. South of this boundary the rocks are younger (Cenozoic) and of volcanic and sedimentary origin.

The northern Cascades were subject to extensive alpine glaciation during the Pleistocene. Many soils formed in the resultant glacial drift and till. Examples are Chinkmin, Kindy, and Philippa soils.

The part of the northern Cascades that is within the survey area has received deposits of tephra since the end of the Pleistocene. The source of the tephra has been volcanic eruptions of Mount Mazama at Crater Lake, Oregon, and perhaps of Glacier Peak and Mount St. Helens. The upper horizons of many of the soils in this part of the survey area formed exclusively in the deposits of tephra.

One of the major bedrock units in the northern part of the survey area is the Snoqualmie Batholith. This unit includes granite, granodiorite, and tonalite. Soils that formed in material weathered from these granitic rocks tend to be coarse textured, permeable, and acid and have a low base status (5). Altapeak and Serene soils are examples. Similar soils formed in material weathered from the granodiorite of the Mount Stuart Batholith in the vicinity of Stevens Pass.

In the area near Stevens Pass, Altapeak, Serene, Index, Klapatche, Teneriffe, and Marblemount soils formed in material weathered from greenschists and phyllites of the Easton Schist Formation. The rocks of the formation are thin, platy, and metamorphic. The substratum of the resultant soils tends to be channery; that is, it has many thin, flat rock fragments that are smaller than 3 inches in diameter.

Soils that formed in the gneissic parent materials generally have a finer texture than that of soils that formed in the other materials in the northern subsection. Nimue, Haywire, Playco, and Nagrom soils tend to correlate with the soils that formed in the parent materials of the southern subsection.

Extrusive igneous rocks of Cenozoic age are virtually the only types of rock in the part of the survey area south of Snoqualmie Pass, except for of a small band of sedimentary rocks, which are also of Cenozoic (Eocene) age. Much of the bedrock has been covered by alpine glacial deposits and lahar and some tephra.

Several of the lithologic formations in the southern subsection contain significant amounts of volcanoclastic rocks, including tuff breccia, volcanic breccia, conglomerate, sandstone, and siltstone. Soils that formed in material weathered from the residual and colluvial rock derived from these volcanoclastics have a very different substratum than that of different phases of the same soils that formed in the andesite and basalt in the area. They are identified as the "tuff substratum" phases of their companion soils, which formed in andesite. Generally, the volcanoclastics are relatively soft and weather more rapidly than the andesites.

Jonas, Littlejohn, Pitcher, and Pheeney soils formed

in material weathered from andesite. They are finer textured than the soils that formed in material weathered from the granitic rocks of the northern subsection. The finer textures and the influence of volcanic ash result in a higher available water capacity and an elevated nutrient status. Cubic rock fragments that have jagged points resulting from hackly fracture of the parent rock are common in the substratum and underlying bedrock of the soils that formed in andesite.

Some soils in the survey area formed in material weathered from Eocene-age sedimentary rocks and in volcanic ash. Vailton soils are an example. The sedimentary rocks are Puget Group sediments made up of sandstone, siltstone, claystone, carbonaceous shale, and coal. The texture of the substratum in these soils and the type of underlying bedrock tend to vary. In areas where the bedrock is claystone or siltstone, the substratum is farther from the surface than in areas where the bedrock is sandstone. Also, the bedrock is less consolidated. The hardness of the sandstone varies. Vailton soils are in the southeastern part of the survey area. Beausite soils formed in similar kinds of parent material, but they are at the lower elevations and in areas of lower relief. They are along the western margin of the survey area, in King County.

As in the northern subsection, much of the bedrock in the southern subsection has received deposits of tephra. The source of this tephra has been the volcanic eruptions of Mount Mazama 6,600 years ago, of Mount St. Helens 450 and 3,000 years ago, and perhaps of Mount Rainier. The eruption of Mount St. Helens in May of 1980 deposited little or no ash in the survey area.

Almost all of the soils in the mountainous parts of the southern subsection formed partially in tephra or at least have tephra incorporated in the upper part. The upper layers of many soils formed exclusively in tephra, which blankets the surface. Cattcreek, Cotteral, Bromo, and Bellicum soils formed mainly in a thick layer of lapilli, which is pyroclastic layer Y of the Mount St. Helens eruption of 3,000 years ago.

Soils that formed in thick deposits of fine ash have a loamy feel after rubbing but have distinctive properties. They have a "smeary" or "greasy" feel when squeezed, have a low bulk density, a high available water capacity, and a high cation-exchange capacity. Cinebar and Zynbar soils are examples.

Volcanic ash and lapilli are incorporated into the colluvial material and blanket the upper few inches of Nimue, Haywire, Playco, and Nagrom soils. The surface layer of these soils is loam or loamy sand. In this survey the term *cinders* has been used to describe the lapilli. Although this material generally is the size of fine gravel, most of the particles crush under a load.

Deposits from two volcanic mudflows, or lahars, are

in the survey area. The largest of these is the Osceola mudflow deposit, which came from a lahar that originated on Mount Rainier and flowed down the valley of the White River about 5,000 years ago. The Electron mudflow occurred only about 600 years ago. It also originated on Mount Rainier, but it traveled down the valley of the Puyallup River. Lemolo, Mowich, Ohop, and Pierking soils formed in these lahars. The unweathered part of these lahars tends to be so dense that it impedes the downward movement of water through the soil. Because of the dense parent material and the low gradient of the surface that resulted from the deposition, Lemolo and Pierking soils are Aquepts and Mowich soils are an aquic intergrade. Ohop soils are better drained than the other soils that formed in the lahars because of their slightly higher position on the landscape.

Elwell, Dobbs, Mashel, and Oakes soils formed in surficial deposits of alpine glacial origin in the southern part of the survey area and in similar deposits of alpine glacial till further north (12). Kindy, Chinkmin, and Philippa soils, all of which have a spodic horizon, formed in alpine glacial till in the northern part of the survey area. They are influenced by incorporated volcanic ash deposits. Because these tills are more local in origin than those of the Puget Trough section, they reflect the features of the dominant rock of which they are composed. In many parts of the survey area, the coarse textured Skykomish soils formed in alpine glacial outwash on terraces. These soils are Typic Haplorthods.

Organic soils (Histosols) form wherever the rate of accumulation of organic matter exceeds the rate of mineralization. This formation usually occurs under conditions of almost continuous saturation, which curtails the circulation of oxygen through the soil (5). Seattle, Shalcar, and Tukwila soils formed in highly decomposed plant remains. They have a mesic soil temperature regime. Mukilteo peat is an organic soil that consists mainly of recognizable fibers of moss.

Geomorphology

This survey area can be divided, in a general sense, into two large geomorphic sections. These are the Puget Trough section and the Northern Cascade Mountains section, which is further divided into northern and southern subsections. Each of these broad areas has a significantly different topography, resulting mainly from the kinds of primary parent materials that occur within the section and the action of climatic events on these materials over time.

The lowlands of the Puget Trough section in the western part of the survey area dominantly consist of

glacial drift plains, kame terraces, glacial lake deltas, ice-marginal stream terraces, and postglacial river terraces. Minor features include eskers, remnant lacustrine plains, kettle lakes, moraines, and the resultant plain of the Osceola volcanic mudflow. Alderwood and Tokul soils formed on the nearly level to sloping glacial drift plains. Because of low relief and a restrictive layer within the soil profile, they are moderately well drained.

Numerous bogs have formed in the low areas on the undulating drift plains. Seattle and Shalcar soils are examples of Histosols that formed in these depressions. They are between areas of the mineral Tokul soils, which are higher on the landscape. Organic soils also formed in other depressions, in small kettles, and around kettle lakes on kame terraces and outwash plains.

Barneston, Skykomish, and Winston soils formed on kame terraces, outwash plains, and ice-marginal stream terraces. Klaus soils formed on glacial outwash terraces that were downcut by postglacial streams and rivers. As a result of this downcutting, alluvium overlies glacial outwash on the river terraces. The discontinuity between the alluvium and the outwash deposits restricts the downward movement of water in the soil and assists in the formation of the spodic horizon and the ortstein in the Klaus soils.

Erosion other than that caused by major river and stream downcutting has not significantly affected soil formation in the lowlands of the Puget Trough section.

Mashel soils formed in the Wingate Hill Drift (12). This drift is derived from an alpine glaciation of Salmon Springs age, which was 35,000 to 50,000 years ago. These soils are deeply weathered and do not have a recognizable layer of compact till. The surface of the soils has been stable for a considerable period. This topographic surface is on the margin of the lowlands and is considered to be in the southern part of the Northern Cascade Mountains section.

The southern part of the Northern Cascade Mountains section is characterized by generally accordant ridge crests separated by steep, deeply dissected valleys (15). Many valley sidewalls are mantled by alpine glacial till or by mudflow. Slumps and earthflows are common topographic features, perhaps

because of the bedded nature of the varied andesite and volcanoclastic flows that make up the bedrock. Foss, Pitcher, and Reichel soils are exclusively in areas of large slumps and earthflow deposits. Many of the large earthflow deposits exhibit hummocky terrain (6).

Ovall, Pheeney, Littlejohn, Haywire, and Nagrom soils are on ridge crests and in areas that are subject to severe geologic erosion. The erosional process led to the formation of Greenwater and National soils, which formed in alluvium containing tephra. The colluvial process contributed to the incorporation of tephra into the solum of the Playco, Nagrom, Nimue, Haywire, Pitcher, and Littlejohn soils.

The northern part of the survey area exhibits topography that is typical of the Northern Cascade Mountains section. It has deep, steep-sided, U-shaped valleys. Exposed bedrock is common on ridges at the higher elevations. Numerous talus slopes are on the valley sidewalls. Hanging valleys and truncated spur ridges are common on the sidewalls of the major valleys. Cirque basins, many containing tarns or small lakes, are numerous on the north-facing sides of the major mountain ridges. In contrast, such cirques are uncommon in the southern part of the survey area and are not necessarily oriented to the north.

Many of the cirque basins have bogs where Cryohemists formed in areas that formerly were tarns. In many places these organic soils formed because the nearly level surface of the bottom of the basin is underlain by compact alpine glacial till and the mouth of the basin is blocked by a moraine. These conditions created a wet environment that slowed the decomposition of organic material and permitted this material to accumulate (4).

Snow avalanching is a dominant, ongoing process that affects the topography of the northern part of the survey area. About 2,700 acres in the survey area is within active avalanche chutes. The soils in these chutes are Orthents, which are very recent soils that do not show any discernible evidence of horizon development. In the deposition zone of the avalanches, at the bottom of the chute, small areas of organic soils are common. These organic soils formed in material that was removed from the slope by avalanches and deposited on a wet site.

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Accordant. The same elevation or nearly the same elevation.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aerobic. Having molecular oxygen as a part of the environment.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial cone. The material washed down the sides of mountains and hills by ephemeral streams and deposited at the mouth of gorges in the form of a moderately steep, conical mass descending equally in all directions from the point of issue.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Aquic. A mostly reducing soil moisture regime that is nearly free of dissolved oxygen because of saturation by ground water or its capillary fringe and that occurs when the soil temperature at a depth of 50 centimeters is above 5 degrees C.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A mineral soil horizon that is characterized by the illuvial accumulation of layer-lattice silicate clays. The argillic horizon has a certain minimum thickness, depending on the thickness of the solum; has a minimum quantity of clay in comparison with an overlying eluvial horizon; and generally has coatings of oriented clay on the surface of pores or peds or bridging sand grains.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and

other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation, in order to allow understory grasses and forbs to recover, or to make conditions favorable for reseeding. It increases forage production and thus reduces the hazard of erosion. Brush management can improve the habitat for some species of wildlife.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Cambic horizon. A mineral soil horizon that is loamy very fine sand or finer textured, has soil structure rather than rock structure, contains some weatherable minerals, and is characterized by the alteration or removal of mineral material as indicated by mottling or gray colors, stronger chromas or redder hues than in underlying horizons, or removal of carbonates. The cambic horizon lacks cementation or induration and has too little evidence of illuviation to meet the requirements of an argillic or spodic horizon.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep narrow, very steep-sided valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles.

Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Cenozoic. Relating to a grand division of geological history that includes the entire interval from the beginning of the Tertiary period to the present.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation by use of chemicals.

Cirque. A semicircular, concave, bowl-like area that has steep faces primarily resulting from glacial ice and snow abrasion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material, rock fragments, or both

moved by creep, slide, or local wash and deposited at the base of steep slopes.

Commercial forest. Forest that is capable of producing merchantable timber, is currently or prospectively accessible, and is not withdrawn from timber production.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conglomerate. A coarse grained, clastic rock composed of rounded to subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer material. Conglomerate is the consolidated equivalent of gravel.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies

among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cryic. A soil temperature regime that has a mean annual soil temperature of more than 0 but less than 8 degrees C, a difference of more than 5 degrees C between the mean summer and the mean winter soil temperature at a depth of 50 centimeters, and a cold summer temperature.

Culmination of the mean annual increment (CMAI).

The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Delta. A body of alluvium whose surface is nearly flat and fan shaped, deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming with the dip of underlying bedded rock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused

by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley, generally more open and with broader bottom land than a ravine or gulch.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A term used to identify a generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Duff mull. A type of forest humus transitional between mull and mor. Duff mull has an h layer and an f layer as well as an A1 horizon.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of people and equipment in fire fighting. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frigid. A soil temperature regime that has a mean annual soil temperature of more than 0 but less than 8 degrees C, a difference of more than 5 degrees C between the mean summer and the mean winter soil temperatures at a depth of 50 centimeters, and a warm summer temperature. An isofrigid regime has similar characteristics, but the summer and winter temperatures differ by less than 5 degrees C.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hanging valley. A tributary valley whose lower end is notably higher than the level of the main valley or a coastal valley whose lower end is notably higher than the shore to which it leads.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hard rock. Rock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C

horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is

absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lahar. Mudflow made up chiefly of volcanoclastic material on the flank of a volcano. The debris carried in the flow includes pyroclastic material, blocks from primary lava flows, and epiclastic material.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Lapilli. Pyroclastics that may be either essential, accessory, or accidental in origin and that range in size from 1 to 64 millimeters in diameter. The fragments may be either solidified or still viscous when they land (though some classifications restrict the term to the former); thus, there is no characteristic shape. An individual fragment is called a *lapillus*.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand or loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Lodgement till. Unstratified glacial drift that was deposited directly by the ice. It consists of clay, sand, gravel, and boulders intermingled in any proportion.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medial. Characterized by a fine-earth fraction that seems loamy to the touch; less than 60 percent (by weight) volcanic ash, cinders, and pumice; and less than 35 percent (by volume) 2 millimeters in diameter or larger.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mesic. A soil temperature regime that has a mean annual soil temperature of 8 degrees C or more but less than 15 degrees C and a difference of more than 5 degrees C between the mean summer and the mean winter soil temperature at a depth of 50 centimeters. An isomesic regime is similar, but the summer and winter temperatures differ by less than 5 degrees C.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A surface horizon of mineral soil that is dark and relatively thick, contains at least 0.58 percent organic carbon, is not massive or hard or very hard when dry, has a base saturation of more than 50 percent when measured at pH 7, has less than 250 parts per million of P_2O_5 soluble in 1 percent citric acid, and is dominantly saturated with bivalent cations.

Mor. A type of forest humus in which an h layer occurs and in which there is practically no mixing of surface organic matter with mineral soil; that is, the transition from the h layer to the A1 horizon is abrupt. (Sometimes differentiated into thick mor, thin mor, granular mor, greasy mor, or felty mor.)

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some

types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Mull. A type of forest humus in which an f layer may or may not be present and in which there is no h layer. The A1 horizon consists of thoroughly mixed organic matter and mineral soil. The transition between the A1 horizon and the horizon beneath is gradual. (Sometimes differentiated into firm mull, sand mull, coarse mull, medium mull, and fine mull.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Mycorrhizal. The symbiotic association of the mycelium of a fungus with the roots of a seed plant.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Ochric epipedon. A surface horizon of mineral soil that is too light in color, too high in chroma, too low in organic carbon, or too thin to be a plaggen, mollic, umbric, anthropic, or histic epipedon or that is both hard and massive when dry.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile.

Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of

moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is also exposed to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Podzolization. A process of soil formation resulting in the genesis of Podzols and Podzolic soils.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Post and piling outlet. A market location where posts and pilings are bought, processed, and sold.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth).

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending

through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream

channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sesquioxide. An oxide containing three atoms of oxygen combined with two of the other constituents in the molecule.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Sidecast material. Soil material that has been pushed by equipment over the downhill side of a road during construction.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average heights of dominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils,

where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level.....	0 to 5 percent
Gently sloping	5 to 10 percent
Moderately sloping	10 to 15 percent
Strongly sloping.....	15 to 30 percent
Moderately steep	30 to 40 percent
Steep	40 to 60 percent
Very steep	60 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft rock. Rock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the Earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation

are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Spodic horizon. A mineral soil horizon that is characterized by the illuvial accumulation of amorphous material made up of aluminum and organic carbon with or without iron. The spodic horizon has a certain minimum thickness and a minimum quantity of extractable carbon plus iron plus aluminum in relation to its content of clay.

Spur. A secondary divide between minor drainage systems that generally has an inverted “V” shape and occurs considerably below the elevation of the associated ridge.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Tailwater. The water just downstream of a structure.

Talus. Rock fragments of any size or shape, commonly

coarse and angular, derived from and lying at the base of a cliff or very steep, rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Tarn. A small, steep-banked mountain lake or pool.

Tephra. Fragmental volcanic debris that is transported from the crater through the air. Tephra does not denote properties of composition, vesicularity, or grain size.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Udic. A soil moisture regime that is dry neither for as long as 90 cumulative days nor for as long as 60 consecutive days in the 90 days following the summer solstice during periods when the soil

temperature at a depth of 50 centimeters is above 5 degrees C.

Umbric epipedon. A surface layer of mineral soil that has the same requirements as the mollic epipedon with respect to color, thickness, organic carbon content, consistence, structure, and P_2O_5 content but that has a base saturation of less than 50 percent when measured at pH 7.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the

downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The action of uprooting and tipping over trees by wind.

Xeric. A soil moisture regime common to Mediterranean climates that have moist, cool winters and warm, dry summers. A limited amount of moisture is evident but does not occur during optimal periods for plant growth. Irrigation or summer fallow is commonly necessary for crop production.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1970-78 at Baring, 1951-78 at Electron Headworks, and 1952-70 at Snoqualmie Pass)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum	Minimum			Less	More		
				temperature higher than--	temperature lower than--			than--	than--		
	<u>° F</u>	<u>° F</u>	<u>° F</u>	<u>° F</u>	<u>° F</u>	<u>Units</u>	<u>In</u>	<u>In</u>	<u>In</u>		<u>In</u>
BARING:											
January----	39.3	28.9	34.1	56	13	14	19.38	10.23	27.41	18	23.7
February----	45.8	32.2	39.0	61	18	65	12.24	5.23	18.18	16	7.8
March-----	49.5	32.9	41.2	68	21	98	11.31	7.79	14.54	15	4.9
April-----	57.3	35.7	46.5	79	27	207	7.18	3.89	10.07	13	1.1
May-----	65.0	41.1	53.1	92	31	406	5.36	3.43	7.09	12	.0
June-----	68.9	47.0	58.0	91	34	540	3.53	2.03	4.85	9	.0
July-----	74.3	50.3	62.3	92	39	691	2.32	.78	3.57	5	.0
August-----	73.3	51.1	62.2	93	41	688	3.51	.81	5.63	6	.0
September--	68.2	46.2	57.2	89	33	516	5.63	1.44	8.96	6	.0
October----	58.9	39.7	49.3	82	27	288	8.07	2.64	12.52	10	.0
November---	45.4	34.0	39.7	63	18	76	16.15	9.50	22.09	17	7.8
December---	39.9	30.6	35.3	55	11	48	19.54	13.09	25.42	19	16.1
Yearly:											
Average----	57.2	39.1	48.2	---	---	---	---	---	---	---	---
Extreme----	---	---	---	95	8	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,637	114.22	94.22	135.14	146	61.4
ELECTRON HEADWORKS:											
January----	39.0	28.2	33.6	55	7	16	11.34	3.80	17.54	15	11.9
February----	43.5	30.9	37.2	57	13	27	5.92	2.74	8.66	13	7.5
March-----	46.5	31.4	39.0	64	14	62	6.19	3.77	8.35	16	9.6
April-----	53.9	33.2	43.6	76	25	128	4.07	1.94	5.91	12	2.4
May-----	62.3	38.2	50.3	89	29	319	4.07	2.55	5.44	11	.0
June-----	67.5	43.2	55.4	87	32	462	3.09	1.70	4.30	7	.0
July-----	74.5	46.8	60.7	92	35	642	1.11	.32	1.75	4	.0
August-----	73.3	46.5	59.9	95	36	617	2.57	.39	4.20	6	.0
September--	66.2	41.7	54.0	87	30	420	3.23	.86	5.11	8	.0
October----	55.1	35.7	45.4	74	24	169	4.06	1.77	6.01	9	.2
November---	43.9	31.6	37.8	60	16	35	8.21	5.10	10.99	15	5.9
December---	39.9	29.8	34.9	56	8	35	9.83	4.92	14.08	17	10.9
Yearly:											
Average----	55.5	36.4	46.0	---	---	---	---	---	---	---	---
Extreme----	---	---	---	96	2	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,932	63.69	49.19	77.31	133	48.4

See footnote at end of table.

TABLE 1.--TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature						Precipitation				
				2 years in 10 will have--		Average	2 years in 10 will have--			Average	
	Average	Average	Average	Maximum	Minimum	number of	Average	Less	More	number of	Average
	daily	daily		temperature	temperature	growing		than--	than--	days with	snowfall
	maximum	minimum		higher	lower	degree				0.10 inch	
				than--	than--	days*				or more	
	° F	° F	° F	° F	° F	Units	In	In	In		In
SNOQUALMIE PASS:											
January----	32.4	21.5	27.0	48	-4	17	18.31	10.95	24.90	21	133.7
February---	38.3	24.8	31.6	53	4	14	11.94	7.73	15.75	16	85.9
March-----	42.3	25.4	33.9	60	5	9	10.40	5.45	14.73	16	96.1
April-----	48.2	29.9	39.1	70	16	51	7.37	4.28	10.12	13	34.7
May-----	57.0	34.6	45.8	80	23	210	3.76	1.66	5.55	9	6.3
June-----	63.3	40.7	52.0	86	31	371	3.35	1.74	4.83	8	.3
July-----	70.1	45.7	57.9	93	35	555	1.52	.31	2.46	4	.5
August-----	69.0	46.1	57.6	92	35	546	2.31	.47	3.75	6	.0
September--	64.5	41.8	53.2	86	30	400	5.37	1.92	8.24	8	.0
October----	53.0	35.4	44.2	74	25	147	9.64	4.88	13.78	12	9.1
November---	39.4	27.9	33.7	58	10	17	14.50	7.65	20.50	16	47.7
December---	33.8	25.0	29.4	48	2	18	17.06	12.07	21.66	21	99.9
Yearly:											
Average---	50.9	33.2	42.1	---	---	---	---	---	---	---	---
Extreme---	---	---	---	93	-8	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,355	105.53	87.11	125.59	150	514.2

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1970-78 at Baring, 1951-78 at Electron Headworks, and 1952-70 at Snoqualmie Pass)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
BARING:			
Last freezing temperature in spring:			
1 year in 10 later than--	Mar. 12	Apr. 15	May 26
2 years in 10 later than--	Mar. 3	Apr. 7	May 18
5 years in 10 later than--	Feb. 13	Mar. 22	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	Nov. 1	Oct. 25	Sept. 21
2 years in 10 earlier than--	Nov. 8	Nov. 1	Sept. 27
5 years in 10 earlier than--	Nov. 24	Nov. 15	Oct. 10
ELECTRON HEADWORKS:			
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 15	May 18	June 8
2 years in 10 later than--	Apr. 4	May 12	June 2
5 years in 10 later than--	Mar. 16	Apr. 30	May 23
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 16	Sept. 27	Aug. 20
2 years in 10 earlier than--	Oct. 29	Oct. 4	Aug. 30
5 years in 10 earlier than--	Nov. 22	Oct. 18	Sept. 18

TABLE 2.--FREEZE DATES IN SPRING AND FALL--Continued

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
SNOQUALMIE PASS:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 7	June 6	June 16
2 years in 10 later than--	Apr. 29	May 29	June 9
5 years in 10 later than--	Apr. 14	May 14	May 26
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 28	Sept. 28	Aug. 6
2 years in 10 earlier than--	Nov. 3	Oct. 5	Aug. 19
5 years in 10 earlier than--	Nov. 13	Oct. 20	Sept. 13

TABLE 3.--GROWING SEASON

(Recorded in the period 1970-78 at Baring,
1951-78 at Electron Headworks, and 1952-70 at
Snoqualmie Pass)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
BARING:			
9 years in 10	252	204	128
8 years in 10	262	215	139
5 years in 10	283	237	159
2 years in 10	307	259	178
1 year in 10	>365	271	189
ELECTRON HEADWORKS:			
9 years in 10	206	145	78
8 years in 10	222	187	92
5 years in 10	251	171	117
2 years in 10	280	187	143
1 year in 10	295	196	156
SNOQUALMIE PASS:			
9 years in 10	181	125	65
8 years in 10	192	136	80
5 years in 10	212	158	109
2 years in 10	233	179	138
1 year in 10	244	191	153

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	King County	Pierce County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
1	Alderwood gravelly loam, 6 to 15 percent slopes-----	2,562	5	2,567	0.2
2	Alderwood gravelly loam, 15 to 30 percent slopes-----	763	185	948	0.1
3	Alkiridge sandy loam, 8 to 30 percent slopes-----	152	2,847	2,999	0.3
4	Altapeak gravelly sandy loam, 8 to 30 percent slopes-----	1,601	0	1,601	0.1
5	Altapeak gravelly sandy loam, 30 to 65 percent slopes-----	13,364	1,515	14,879	1.3
6	Altapeak gravelly sandy loam, 65 to 90 percent slopes-----	2,113	31	2,144	0.2
7	Altapeak-Rock outcrop complex, 45 to 90 percent slopes-----	3,503	454	3,957	0.3
8	Andic Cryumbrepts, 30 to 90 percent slopes-----	409	2,385	2,794	0.2
9	Arents, 0 to 8 percent slopes-----	881	222	1,103	0.1
10	Barneston gravelly coarse sandy loam, 0 to 6 percent slopes-----	4,631	5	4,636	0.4
11	Barneston gravelly coarse sandy loam, 6 to 30 percent slopes-----	15,051	4,588	19,639	1.7
12	Barneston gravelly coarse sandy loam, 30 to 65 percent slopes-----	2,156	1,080	3,236	0.3
13	Barneston gravelly sandy loam, 0 to 8 percent slopes-----	16,575	0	16,575	1.4
14	Barneston gravelly sandy loam, 8 to 30 percent slopes-----	3,821	0	3,821	0.3
15	Barneston gravelly sandy loam, 30 to 65 percent slopes-----	4,964	0	4,964	0.4
16	Barneston gravelly sandy loam, windswept, 6 to 30 percent slopes-----	1,014	0	1,014	0.1
17	Beausite gravelly loam, 6 to 30 percent slopes-----	467	0	467	*
18	Beausite gravelly loam, 30 to 65 percent slopes-----	3,272	0	3,272	0.3
19	Beausite gravelly loam, 65 to 90 percent slopes-----	0	3,455	3,455	0.3
20	Belfast silt loam, 0 to 2 percent slopes-----	340	14	354	*
21	Bellicum very cindery loamy sand, 8 to 30 percent slopes---	0	1,111	1,111	0.1
22	Bellicum very cindery loamy sand, 30 to 65 percent slopes---	0	3,946	3,946	0.3
23	Blethen gravelly loam, 5 to 30 percent slopes-----	8,052	0	8,052	0.7
24	Blethen gravelly loam, 30 to 65 percent slopes-----	10,752	0	10,752	0.9
25	Borohemists, 0 to 2 percent slopes-----	368	440	808	0.1
26	Bromo very cindery sandy loam, 30 to 65 percent slopes----	0	738	738	0.1
27	Cattcreek very cindery loamy sand, 30 to 65 percent slopes-	0	2,971	2,971	0.3
28	Cattcreek very cindery loamy sand, 65 to 90 percent slopes-	0	750	750	0.1
29	Cattcreek very cindery loamy sand, sandstone substratum, 30 to 65 percent slopes-----	0	2,513	2,513	0.2
30	Cattcreek very cindery loamy sand, sandstone substratum, 65 to 90 percent slopes-----	0	609	609	0.1
31	Cattcreek very cindery loamy sand, till substratum, 8 to 30 percent slopes-----	0	3,449	3,449	0.3
32	Cayuse sandy loam, 8 to 30 percent slopes-----	0	608	608	0.1
33	Cayuse sandy loam, 30 to 65 percent slopes-----	0	2,526	2,526	0.2
34	Chinkmin sandy loam, 0 to 15 percent slopes-----	2,015	525	2,540	0.2
35	Chinkmin sandy loam, 15 to 30 percent slopes-----	8,689	2,157	10,846	0.9
36	Chinkmin sandy loam, 30 to 65 percent slopes-----	4,370	549	4,919	0.4
37	Chinkmin sandy loam, cold, 0 to 15 percent slopes-----	782	0	782	0.1
38	Chinkmin sandy loam, cold, 15 to 30 percent slopes-----	624	22	646	0.1
39	Christoff sandy loam, 6 to 30 percent slopes-----	1,571	0	1,571	0.1
40	Christoff sandy loam, 30 to 65 percent slopes-----	524	0	524	*
41	Chuckanut loam, 6 to 15 percent slopes-----	972	0	972	0.1
42	Chuckanut loam, 15 to 30 percent slopes-----	2,359	0	2,359	0.2
43	Chuckanut loam, 30 to 65 percent slopes-----	1,115	58	1,173	0.1
44	Cinebar silt loam, 6 to 15 percent slopes-----	0	2,659	2,659	0.2
45	Cinebar silt loam, 15 to 30 percent slopes-----	24	318	342	*
46	Cinebar silt loam, 30 to 45 percent slopes-----	231	643	874	0.1
47	Cotteral very cindery sandy loam, 8 to 30 percent slopes---	0	547	547	*
48	Cotteral very cindery sandy loam, cold, 30 to 65 percent slopes-----	0	350	350	*
49	Crinker very channery loam, 30 to 65 percent slopes-----	1,694	0	1,694	0.1
50	Cryofluvents, 0 to 8 percent slopes-----	673	720	1,393	0.1
51	Cryochemists, 0 to 2 percent slopes-----	395	870	1,265	0.1
52	Dobbs loam, 8 to 30 percent slopes-----	0	300	300	*

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	King County	Pierce County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
53	Edgewick silt loam, 0 to 3 percent slopes-----	3,707	0	3,707	0.3
54	Elwell silt loam, 6 to 30 percent slopes-----	6,531	8,163	14,694	1.2
55	Elwell silt loam, 30 to 65 percent slopes-----	2,692	1,288	3,980	0.3
56	Ethania very cindery loamy sand, 30 to 65 percent slopes---	0	2,447	2,447	0.2
57	Ethania very cindery loamy sand, 65 to 90 percent slopes---	0	2,264	2,264	0.2
58	Ethania very cindery loamy sand, sandstone substratum, 30 to 65 percent slopes-----	0	5,091	5,091	0.4
59	Ethania very cindery loamy sand, sandstone substratum, 65 to 90 percent slopes-----	0	1,348	1,348	0.1
60	Ethania very cindery loamy sand, till substratum, 8 to 30 percent slopes-----	0	2,989	2,989	0.3
61	Foss stony sandy loam, 8 to 30 percent slopes-----	0	1,247	1,247	0.1
62	Foss stony sandy loam, 30 to 65 percent slopes-----	97	296	393	*
63	Gallup loam, 6 to 30 percent slopes-----	2,001	0	2,001	0.2
64	Gallup loam, 30 to 65 percent slopes-----	992	0	992	0.1
65	Gallup loam, breccia substratum, 30 to 65 percent slopes---	351	0	351	*
66	Getchell loam, 6 to 15 percent slopes-----	1,268	0	1,268	0.1
67	Getchell loam, 15 to 30 percent slopes-----	1,715	0	1,715	0.1
68	Getchell loam, 30 to 65 percent slopes-----	543	0	543	*
69	Greenwater loamy sand, 0 to 8 percent slopes-----	48	1,206	1,254	0.1
70	Grotto gravelly loamy sand, 0 to 8 percent slopes-----	2,875	4,211	7,086	0.6
71	Hartnit loam, 8 to 30 percent slopes-----	501	0	501	*
72	Haywire sandy loam, 8 to 30 percent slopes-----	705	906	1,611	0.1
73	Haywire sandy loam, 30 to 65 percent slopes-----	10,506	6,970	17,476	1.5
74	Haywire loamy sand, tuff substratum, 8 to 30 percent slopes-----	323	918	1,241	0.1
75	Haywire loamy sand, tuff substratum, 30 to 65 percent slopes-----	4,017	4,587	8,604	0.7
76	Hinker gravelly sandy loam, 8 to 30 percent slopes-----	796	0	796	0.1
77	Hinker gravelly sandy loam, 30 to 65 percent slopes-----	1,998	877	2,875	0.2
78	Hinker gravelly sandy loam, 65 to 90 percent slopes-----	287	0	287	*
79	Humaquepts, 0 to 5 percent slopes-----	1,030	4,004	5,034	0.4
80	Index loamy sand, 8 to 30 percent slopes-----	449	0	449	*
81	Index loamy sand, 30 to 65 percent slopes-----	13,348	1,255	14,603	1.2
82	Index loamy sand, 65 to 90 percent slopes-----	1,533	0	1,533	0.1
83	Index-Rock outcrop complex, 45 to 90 percent slopes-----	1,969	753	2,722	0.2
84	Jonas gravelly loam, tuff substratum, 15 to 30 percent slopes-----	95	1,699	1,794	0.2
85	Jonas gravelly loam, tuff substratum, 30 to 65 percent slopes-----	0	3,270	3,270	0.3
86	Jonas gravelly silt loam, 15 to 30 percent slopes-----	373	3,040	3,413	0.3
87	Jonas gravelly silt loam, 30 to 65 percent slopes-----	564	13,201	13,765	1.2
88	Jonas gravelly silt loam, 65 to 90 percent slopes-----	0	850	850	0.1
89	Kaleetan sandy loam, 8 to 30 percent slopes-----	2,831	0	2,831	0.2
90	Kaleetan sandy loam, 30 to 65 percent slopes-----	23,169	0	23,169	2.0
91	Kaleetan sandy loam, windswept, 30 to 65 percent slopes----	953	0	953	0.1
92	Kaleetan sandy loam, till substratum, 8 to 30 percent slopes-----	6,492	0	6,492	0.5
93	Kaleetan sandy loam, till substratum, 30 to 65 percent slopes-----	6,178	0	6,178	0.5
94	Kaleetan sandy loam, tuff substratum, 8 to 30 percent slopes-----	400	0	400	*
95	Kaleetan sandy loam, tuff substratum, 30 to 65 percent slopes-----	3,521	0	3,521	0.3
96	Kanaskat gravelly sandy loam, 0 to 30 percent slopes-----	1,719	187	1,906	0.2
97	Kanaskat gravelly sandy loam, 30 to 65 percent slopes-----	3,848	311	4,159	0.4
98	Kanaskat gravelly sandy loam, tuff substratum, 8 to 30 percent slopes-----	230	0	230	*
99	Kanaskat gravelly sandy loam, tuff substratum, 30 to 65 percent slopes-----	1,148	0	1,148	0.1

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	King County	Pierce County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
100	Kapowsin gravelly loam, 6 to 15 percent slopes-----	0	480	480	*
101	Kapowsin gravelly loam, 15 to 30 percent slopes-----	0	1,202	1,202	0.1
102	Kapowsin gravelly loam, 30 to 65 percent slopes-----	0	601	601	0.1
103	Kindy gravelly loam, 0 to 15 percent slopes-----	932	61	993	0.1
104	Kindy gravelly loam, 15 to 30 percent slopes-----	2,634	1,061	3,695	0.3
105	Kindy gravelly loam, 30 to 65 percent slopes-----	934	519	1,453	0.1
106	Klaber silt loam, 0 to 8 percent slopes-----	1,038	1,211	2,249	0.2
107	Klaber-Cinebar silt loams, 0 to 8 percent slopes-----	0	1,438	1,438	0.1
108	Klapatche loamy sand, 8 to 30 percent slopes-----	746	0	746	0.1
109	Klapatche loamy sand, 30 to 65 percent slopes-----	7,762	517	8,279	0.7
110	Klapatche-Rock outcrop complex, 45 to 90 percent slopes----	3,684	124	3,808	0.3
111	Klaus sandy loam, 0 to 8 percent slopes-----	11,527	0	11,527	1.0
112	Klaus sandy loam, 8 to 15 percent slopes-----	464	0	464	*
113	Klaus sandy loam, 30 to 65 percent slopes-----	1,465	0	1,465	0.1
114	Klaus sandy loam, windswept, 0 to 8 percent slopes-----	716	0	716	0.1
115	Klaus sandy loam, windswept, 30 to 65 percent slopes-----	360	0	360	*
116	Larrupin loamy sand, 3 to 30 percent slopes-----	0	2,171	2,171	0.2
117	Larrupin loamy sand, 30 to 65 percent slopes-----	0	1,589	1,589	0.1
118	Larrupin loamy sand, hard substratum, 6 to 30 percent slopes-----	0	1,663	1,663	0.1
119	Lemolo silt loam, 0 to 8 percent slopes-----	2,757	764	3,521	0.3
120	Littlejohn gravelly sandy loam, 8 to 30 percent slopes-----	85	333	418	*
121	Littlejohn gravelly sandy loam, 30 to 65 percent slopes-----	5,063	1,233	6,296	0.5
122	Littlejohn gravelly sandy loam, windswept, 30 to 65 percent slopes-----	261	0	261	*
123	Littlejohn gravelly sandy loam, tuff substratum, 8 to 30 percent slopes-----	204	82	286	*
124	Littlejohn gravelly sandy loam, tuff substratum, 30 to 65 percent slopes-----	3,252	1,630	4,882	0.4
125	Littlejohn gravelly sandy loam, tuff substratum, windswept, 30 to 65 percent slopes-----	328	0	328	*
126	Littlejohn-Rock outcrop complex, 30 to 90 percent slopes----	2,899	502	3,401	0.3
127	Lynnwood loamy fine sand, 6 to 15 percent slopes-----	92	722	814	0.1
128	Marblemount gravelly loamy sand, 8 to 30 percent slopes----	551	0	551	*
129	Marblemount gravelly loamy sand, 30 to 65 percent slopes----	4,144	0	4,144	0.3
130	Marblemount gravelly loamy sand, schist substratum, 30 to 65 percent slopes-----	598	0	598	0.1
131	Marblemount-Rock outcrop complex, 45 to 90 percent slopes----	2,954	0	2,954	0.2
132	Mashel silt loam, 5 to 30 percent slopes-----	907	7,444	8,351	0.7
133	Mashel silt loam, 30 to 65 percent slopes-----	0	3,055	3,055	0.3
134	Melakwa sandy loam, 8 to 30 percent slopes-----	285	0	285	*
135	Melakwa sandy loam, 30 to 65 percent slopes-----	7,206	0	7,206	0.6
136	Melakwa sandy loam, windswept, 30 to 65 percent slopes-----	302	0	302	*
137	Melakwa sandy loam, tuff substratum, 30 to 65 percent slopes-----	297	0	297	*
138	Melakwa-Rock outcrop complex, 45 to 90 percent slopes----	2,673	0	2,673	0.2
139	Mowich silt loam, 0 to 15 percent slopes-----	0	3,187	3,187	0.3
140	Mukilteo peat, 0 to 1 percent slopes-----	557	0	557	*
141	Nagrom sandy loam, 8 to 30 percent slopes-----	278	695	973	0.1
142	Nagrom sandy loam, 30 to 65 percent slopes-----	12,909	2,344	15,253	1.3
143	Nagrom gravelly loam, tuff substratum, 8 to 30 percent slopes-----	220	570	790	0.1
144	Nagrom gravelly loam, tuff substratum, 30 to 65 percent slopes-----	3,904	3,120	7,024	0.6
145	Nagrom-Rock outcrop complex, 30 to 90 percent slopes----	7,131	1,665	8,796	0.7
146	Nargar fine sandy loam, 0 to 15 percent slopes-----	2,914	0	2,914	0.2
147	Nargar fine sandy loam, 15 to 30 percent slopes-----	1,704	0	1,704	0.1
148	Nargar-Pastik complex, 35 to 70 percent slopes-----	1,954	0	1,954	0.2
149	National cindery sandy loam, 0 to 8 percent slopes-----	0	5,026	5,026	0.4
150	Neilton gravelly loamy sand, 2 to 15 percent slopes-----	400	0	400	*
151	Nimue loamy sand, 6 to 30 percent slopes-----	3,297	3,005	6,302	0.5

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	King County	Pierce County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
152	Nimue loamy sand, 30 to 65 percent slopes-----	24,909	15,747	40,656	3.4
153	Nimue loamy sand, 65 to 90 percent slopes-----	1,301	1,384	2,685	0.2
154	Nimue loamy sand, tuff substratum, 8 to 30 percent slopes--	2,750	2,976	5,726	0.5
155	Nimue loamy sand, tuff substratum, 30 to 65 percent slopes--	17,401	14,540	31,941	2.7
156	Nimue-Rock outcrop complex, 30 to 90 percent slopes-----	2,838	6,745	9,583	0.8
157	Nooksack silt loam, 0 to 2 percent slopes-----	2,709	0	2,709	0.2
158	Norma loam, 0 to 3 percent slopes-----	1,289	288	1,577	0.1
159	Oakes gravelly loam, 6 to 30 percent slopes-----	1,165	3,339	4,504	0.4
160	Oakes cobbly loam, 6 to 30 percent slopes-----	0	6,344	6,344	0.5
161	Oakes cobbly loam, 30 to 65 percent slopes-----	0	3,519	3,519	0.3
162	Ogarty gravelly loam, 8 to 30 percent slopes-----	2,368	540	2,908	0.2
163	Ogarty gravelly loam, 30 to 65 percent slopes-----	5,118	2,484	7,602	0.6
164	Ogarty-Rock outcrop complex, 45 to 90 percent slopes-----	1,123	559	1,682	0.1
165	Ohop sandy loam, 0 to 8 percent slopes-----	0	1,652	1,652	0.1
166	Ohop very gravelly loam, 0 to 15 percent slopes-----	0	1,484	1,484	0.1
167	Olomount gravelly loam, 8 to 30 percent slopes-----	472	0	472	*
168	Olomount gravelly loam, 30 to 65 percent slopes-----	741	0	741	0.1
169	Olomount-Rock outcrop complex, 45 to 90 percent slopes----	686	0	686	0.1
170	Oridia silt loam, 0 to 2 percent slopes-----	1,429	0	1,429	0.1
171	Orthents, avalanche chutes-Humods complex, 30 to 100 percent slopes-----	3,658	863	4,521	0.4
172	Ovall gravelly loam, 15 to 30 percent slopes-----	323	254	577	*
173	Ovall gravelly loam, 30 to 65 percent slopes-----	427	2,334	2,761	0.2
174	Pastik silt loam, 0 to 30 percent slopes-----	1,171	0	1,171	0.1
175	Persis sandy loam, 0 to 8 percent slopes-----	2,104	0	2,104	0.2
176	Persis sandy loam, windswept, 0 to 8 percent slopes-----	237	0	237	*
177	Pheeney gravelly loam, 8 to 30 percent slopes-----	0	663	663	0.1
178	Pheeney gravelly loam, 30 to 65 percent slopes-----	169	4,601	4,770	0.4
179	Pheeney gravelly silt loam, tuff substratum, 8 to 30 percent slopes-----	0	187	187	*
180	Pheeney gravelly silt loam, tuff substratum, 30 to 65 percent slopes-----	69	1,763	1,832	0.2
181	Pheeney-Rock outcrop complex, 30 to 90 percent slopes-----	0	1,534	1,534	0.1
182	Philippa sandy loam, 0 to 30 percent slopes-----	6,950	0	6,950	0.6
183	Philippa sandy loam, 30 to 65 percent slopes-----	3,445	0	3,445	0.3
184	Pierking gravelly sandy loam, 0 to 3 percent slopes-----	24	517	541	*
185	Pierking-Borochemists complex, 0 to 5 percent slopes-----	0	2,084	2,084	0.2
186	Pierking-Mowich complex, 2 to 15 percent slopes-----	0	330	330	*
187	Pilchuck loamy fine sand, 0 to 3 percent slopes-----	1,298	1,573	2,871	0.2
188	Pitcher sandy loam, 8 to 30 percent slopes-----	4,566	2,809	7,375	0.6
189	Pitcher sandy loam, 30 to 65 percent slopes-----	21,803	5,944	27,747	2.3
190	Pitcher sandy loam, windswept, 30 to 65 percent slopes----	469	0	469	*
191	Pitcher sandy loam, tuff substratum, 8 to 30 percent slopes-----	3,946	2,145	6,091	0.5
192	Pitcher sandy loam, tuff substratum, 30 to 65 percent slopes-----	18,945	8,130	27,075	2.3
193	Pitcher sandy loam, tuff substratum, windswept, 30 to 65 percent slopes-----	2,745	0	2,745	0.2
194	Pitcher-Rock outcrop complex, 30 to 90 percent slopes-----	483	86	569	*
195	Pits-----	445	33	478	*
196	Playco loamy sand, 8 to 30 percent slopes-----	6,237	1,928	8,165	0.7
197	Playco loamy sand, 30 to 65 percent slopes-----	36,922	8,572	45,494	3.8
198	Playco loamy sand, 65 to 90 percent slopes-----	1,301	286	1,587	0.1
199	Playco very gravelly loamy sand, tuff substratum, 8 to 30 percent slopes-----	3,496	1,705	5,201	0.4
200	Playco very gravelly loamy sand, tuff substratum, 30 to 65 percent slopes-----	27,048	12,393	39,441	3.3
201	Playco-Rock outcrop complex, 30 to 90 percent slopes-----	2,161	1,536	3,697	0.3
202	Puget silty clay loam, 0 to 2 percent slopes-----	1,137	0	1,137	0.1
203	Ragnar loam, 6 to 15 percent slopes-----	260	200	460	*

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	King County	Pierce County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
204	Ragnar loam, 15 to 30 percent slopes-----	290	59	349	*
205	Ragnar-Lynnwood complex, 2 to 15 percent slopes-----	648	0	648	0.1
206	Ragnar-Lynnwood complex, 30 to 45 percent slopes-----	175	136	311	*
207	Reggad very cobbly muck, 30 to 90 percent slopes-----	20,912	826	21,738	1.8
208	Reggad-Haywire complex, 45 to 90 percent slopes-----	2,389	351	2,740	0.2
209	Reggad-Klapatche-Rock outcrop complex, 45 to 90 percent slopes-----	2,082	0	2,082	0.2
210	Reggad-Serene complex, 45 to 90 percent slopes-----	10,517	196	10,713	0.9
211	Reichel silt loam, 6 to 30 percent slopes-----	489	1,894	2,383	0.2
212	Reichel silt loam, 30 to 65 percent slopes-----	512	1,617	2,129	0.2
213	Reichel silt loam, tuff substratum, 15 to 30 percent slopes-----	0	635	635	0.1
214	Reichel silt loam, tuff substratum, 30 to 65 percent slopes-----	0	1,002	1,002	0.1
215	Riverwash-----	513	369	882	0.1
216	Rober loam, 0 to 30 percent slopes-----	8,394	0	8,394	0.7
217	Rober loam, 30 to 65 percent slopes-----	834	0	834	0.1
218	Rock outcrop-----	10,418	4,564	14,982	1.3
219	Rock outcrop-Cattcreek complex, 65 to 90 percent slopes----	0	5,206	5,206	0.4
220	Rock outcrop-Cayuse complex, 30 to 90 percent slopes-----	0	2,425	2,425	0.2
221	Rock outcrop-Haywire complex, 45 to 90 percent slopes-----	5,055	8,495	13,550	1.1
222	Rock outcrop-Rubble land-Haywire complex, 45 to 90 percent slopes-----	5,365	1,489	6,854	0.6
223	Rock outcrop-Rubble land-Serene complex, 45 to 90 percent slopes-----	16,442	757	17,199	1.4
224	Rubble land-----	10,475	1,461	11,936	1.0
225	Rugles silt loam, 0 to 15 percent slopes-----	236	4,507	4,743	0.4
226	Salal silt loam, 0 to 2 percent slopes-----	558	0	558	*
227	Sauk silt loam, 0 to 8 percent slopes-----	2,514	0	2,514	0.2
228	Scamman silt loam, 6 to 15 percent slopes-----	73	4,990	5,063	0.4
229	Scamman silt loam, 15 to 30 percent slopes-----	0	797	797	0.1
230	Scamman silt loam, 30 to 65 percent slopes-----	0	361	361	*
231	Seattle muck, 0 to 1 percent slopes-----	2,867	0	2,867	0.2
232	Serene gravelly sandy loam, 8 to 30 percent slopes-----	1,448	0	1,448	0.1
233	Serene gravelly sandy loam, 30 to 65 percent slopes-----	7,308	530	7,838	0.7
234	Serene-Rock outcrop complex, 45 to 90 percent slopes-----	3,139	167	3,306	0.3
235	Shalcar muck, 0 to 1 percent slopes-----	1,442	400	1,842	0.2
236	Si silt loam, 0 to 2 percent slopes-----	1,723	0	1,723	0.1
237	Skykomish gravelly sandy loam, 0 to 30 percent slopes-----	5,301	0	5,301	0.4
238	Skykomish gravelly sandy loam, 30 to 65 percent slopes-----	1,299	0	1,299	0.1
239	Skykomish gravelly sandy loam, windswept, 0 to 30 percent slopes-----	312	0	312	*
240	Skykomish very stony loam, 0 to 30 percent slopes-----	1,623	0	1,623	0.1
241	Snoqualmie loamy fine sand, 0 to 8 percent slopes-----	1,994	661	2,655	0.2
242	Snoqualmie loamy fine sand, windswept, 0 to 8 percent slopes-----	399	0	399	*
243	Spukwush loamy sand, 8 to 30 percent slopes-----	239	579	818	0.1
244	Stahl very gravelly silt loam, 30 to 65 percent slopes-----	216	1,596	1,812	0.2
245	Stahl very gravelly silt loam, tuff substratum, 15 to 30 percent slopes-----	0	370	370	*
246	Stahl very gravelly silt loam, tuff substratum, 30 to 65 percent slopes-----	0	1,452	1,452	0.1
247	Sulsavar loam, 0 to 8 percent slopes-----	1,653	1,037	2,690	0.2
248	Sultan silt loam, 0 to 2 percent slopes-----	571	12	583	*
249	Teneriffe loamy sand, 8 to 30 percent slopes-----	932	0	932	0.1
250	Teneriffe loamy sand, 30 to 65 percent slopes-----	9,499	0	9,499	0.8
251	Teneriffe loamy sand, windswept, 30 to 65 percent slopes---	252	0	252	*
252	Teneriffe very gravelly sandy loam, channery substratum, 8 to 30 percent slopes-----	330	0	330	*

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	King County	Pierce County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
253	Teneriffe very gravelly sandy loam, channery substratum, 30 to 65 percent slopes-----	1,770	0	1,770	0.1
254	Tokul gravelly loam, 0 to 6 percent slopes-----	9,137	0	9,137	0.8
255	Tokul gravelly loam, 6 to 15 percent slopes-----	33,827	114	33,941	2.9
256	Tokul gravelly loam, 15 to 30 percent slopes-----	14,908	236	15,144	1.3
257	Tokul gravelly loam, 30 to 65 percent slopes-----	6,051	0	6,051	0.5
258	Tokul-Pastik complex, 45 to 90 percent slopes-----	6,172	0	6,172	0.5
259	Tokul-Pastik complex, windswept, 45 to 90 percent slopes---	312	0	312	*
260	Treen loam, 30 to 90 percent slopes-----	473	0	473	*
261	Tukwila muck, 0 to 1 percent slopes-----	148	7	155	*
262	Tusip sandy loam, 15 to 30 percent slopes-----	0	1,751	1,751	0.1
263	Tusip sandy loam, 30 to 65 percent slopes-----	0	2,502	2,502	0.2
264	Typic Haploorthods, 35 to 100 percent slopes-----	1,890	2,185	4,075	0.3
265	Typic Udifluvents, 0 to 3 percent slopes-----	1,406	0	1,406	0.1
266	Typic Udifluvents, windswept, 0 to 3 percent slopes-----	420	0	420	*
267	Udifluvents, moist, 0 to 8 percent slopes-----	5,823	2,577	8,400	0.7
268	Vailton silt loam, 8 to 30 percent slopes-----	0	985	985	0.1
269	Vailton silt loam, 30 to 65 percent slopes-----	8	4,159	4,167	0.4
270	Voight silt loam, 6 to 15 percent slopes-----	0	386	386	*
271	Voight silt loam, 15 to 30 percent slopes-----	0	1,320	1,320	0.1
272	Voight silt loam, 30 to 65 percent slopes-----	0	1,010	1,010	0.1
273	Welcome loam, 0 to 30 percent slopes-----	886	0	886	0.1
274	Welcome loam, 30 to 65 percent slopes-----	332	0	332	*
275	Wilkeson gravelly silt loam, 6 to 15 percent slopes-----	123	607	730	0.1
276	Wilkeson gravelly silt loam, 15 to 30 percent slopes-----	342	3,335	3,677	0.3
277	Wilkeson gravelly silt loam, 30 to 45 percent slopes-----	0	3,485	3,485	0.3
278	Winston loam, 0 to 8 percent slopes-----	2,381	1,667	4,048	0.3
279	Winston loam, 8 to 30 percent slopes-----	1,659	1,139	2,798	0.2
280	Winston loam, windswept, 0 to 30 percent slopes-----	484	0	484	*
281	Woodinville silt loam, 0 to 2 percent slopes-----	210	0	210	*
282	Zynbar loam, 6 to 30 percent slopes-----	228	16,153	16,381	1.4
283	Zynbar loam, 30 to 65 percent slopes-----	159	5,680	5,839	0.5
284	Zynbar silt loam, till substratum, 0 to 15 percent slopes--	0	3,681	3,681	0.3
	Water-----	5,237	2,580	7,817	0.7
	Total-----	791,002	396,128	1,187,130	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
20	Belfast silt loam, 0 to 2 percent slopes
53	Edgewick silt loam, 0 to 3 percent slopes
106	Klaber silt loam, 0 to 8 percent slopes (where drained)
107	Klaber-Cinebar silt loams, 0 to 8 percent slopes (where drained)
119	Lemolo silt loam, 0 to 8 percent slopes (where drained)
140	Mukilteo peat, 0 to 1 percent slopes (where drained)
157	Nooksack silt loam, 0 to 2 percent slopes
158	Norma loam, 0 to 3 percent slopes (where drained)
170	Oridia silt loam, 0 to 2 percent slopes (where drained)
175	Persis sandy loam, 0 to 8 percent slopes
202	Puget silty clay loam, 0 to 2 percent slopes (where drained)
226	Salal silt loam, 0 to 2 percent slopes
227	Sauk silt loam, 0 to 8 percent slopes
231	Seattle muck, 0 to 1 percent slopes (where drained)
235	Shalcar muck, 0 to 1 percent slopes (where drained)
236	Si silt loam, 0 to 2 percent slopes
247	Sulsavar loam, 0 to 8 percent slopes
248	Sultan silt loam, 0 to 2 percent slopes
254	Tokul gravelly loam, 0 to 6 percent slopes
261	Tukwila muck, 0 to 1 percent slopes (where drained)
278	Winston loam, 0 to 8 percent slopes
281	Woodinville silt loam, 0 to 2 percent slopes (where drained)

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
I	---	---	---	---	---
II	11,951	8,592	3,359	---	---
III	144,370	135,319	9,051	---	---
IV	173,497	147,233	14,060	12,204	---
V	4,288	---	4,288	---	---
VI	119,610	83,174	28,033	8,403	---
VII	614,044	562,065	1,822	50,157	---
VIII	111,614	---	882	110,732	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
1, 2----- Alderwood	11D	Slight	Moderate	Moderate	Moderate	Moderate	Douglas fir----- Red alder----- Western redcedar----- Western hemlock----- Pacific madrone-----	111 --- --- --- ---	11 --- --- --- ---	Douglas fir, red alder.
3----- Alkiridge	14F	Slight	Moderate	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir----- Western redcedar-----	95 --- --- --- ---	14 --- --- --- ---	Western hemlock, noble fir.
4----- Altapeak	7F	Slight	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar----- Mountain hemlock----	65 --- --- --- ---	7 --- --- --- ---	Noble fir, western hemlock.
5, 6----- Altapeak	7R	Moderate	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar----- Mountain hemlock----	65 --- --- --- ---	7 --- --- --- ---	Noble fir, western hemlock.
7**; Altapeak-----	7R	Severe	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar----- Mountain hemlock----	65 --- --- --- ---	7 --- --- --- ---	Noble fir, western hemlock.
Rock outcrop.										
8----- Andic Cryumbrepts	6R	Severe	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Subalpine fir----- Mountain hemlock----	55 --- --- ---	6 --- --- ---	Western hemlock, mountain hemlock, Pacific silver fir.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
10, 11----- Barneston	11F	Slight	Slight	Moderate	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder----- Bigleaf maple-----	118 --- --- --- ---	11 --- --- --- ---	Douglas fir.
12----- Barneston	11R	Moderate	Severe	Moderate	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar-----	110 90 ---	11 9 ---	Douglas fir.
13, 14----- Barneston	11F	Slight	Slight	Moderate	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder----- Bigleaf maple-----	118 --- --- --- ---	11 --- --- --- ---	Douglas fir.
15----- Barneston	11R	Moderate	Severe	Moderate	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder----- Bigleaf maple-----	118 --- --- --- ---	11 --- --- --- ---	Douglas fir.
16----- Barneston	9F	Slight	Slight	Moderate	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar-----	100 --- ---	9 --- ---	Douglas fir.
17----- Beausite	11F	Slight	Slight	Severe	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	118 --- --- ---	11 --- --- ---	Douglas fir, western hemlock.
18----- Beausite	11R	Moderate	Severe	Severe	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	118 --- --- ---	11 --- --- ---	Douglas fir, western hemlock.
19----- Beausite	11R	Severe	Severe	Severe	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	111 --- --- ---	11 --- --- ---	Douglas fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
20----- Belfast	12W	Slight	Moderate	Moderate	Slight	Severe	Douglas fir----- Black cottonwood---- Red alder----- Bigleaf maple----- Western redcedar----	120 --- --- --- ---	12 --- --- --- ---	Douglas fir, red alder.
21----- Bellicum	18F	Moderate	Moderate	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Pacific silver fir-- Western redcedar----	112 112 --- --- ---	10 18 --- --- ---	Douglas fir, western hemlock, Pacific silver fir.
22----- Bellicum	18R	Severe	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Pacific silver fir-- Western redcedar----	112 112 --- --- ---	10 18 --- --- ---	Douglas fir, western hemlock, Pacific silver fir.
23----- Blethen	11F	Slight	Slight	Moderate	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar----	115 --- --- --- ---	11 --- --- --- ---	Douglas fir, red alder.
24----- Blethen	11R	Moderate	Severe	Moderate	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar----	115 --- --- --- ---	11 --- --- --- ---	Douglas fir, red alder.
26----- Bromo	17R	Severe	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar---- Pacific silver fir-- Bigleaf maple-----	118 106 --- --- --- ---	11 17 --- --- --- ---	Douglas fir, western hemlock.
27, 28, 29, 30----- Cattcreek	13R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar---- Western white pine-- Alaska cedar-----	86 90 --- --- --- --- ---	13 8 --- --- --- --- ---	Douglas fir, noble fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
31----- Cattcreek	13F	Moderate	Moderate	Moderate	Moderate	Slight	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar--- Western white pine-- Alaska cedar-----	86 90 --- --- --- --- ---	13 8 --- --- --- --- ---	Douglas fir, noble fir, western hemlock.
32----- Cayuse	6N	Slight	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Subalpine fir----- Engelmann spruce----	55 --- --- ---	6 --- --- ---	Noble fir, western hemlock.
33----- Cayuse	6R	Moderate	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Subalpine fir----- Engelmann spruce----	55 --- --- ---	6 --- --- ---	Noble fir, western hemlock.
34, 35----- Chinkmin	7D	Slight	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar----- Mountain hemlock----	65 --- --- --- ---	7 --- --- --- ---	Noble fir, western hemlock.
36----- Chinkmin	7R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar----- Mountain hemlock----	65 --- --- --- ---	7 --- --- --- ---	Western hemlock.
37, 38----- Chinkmin	6D	Slight	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar----- Mountain hemlock----	60 --- --- --- ---	6 --- --- --- ---	Noble fir.
39----- Christoff	10A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar--- Red alder-----	106 --- --- ---	10 --- --- ---	Douglas fir.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
40----- Christoff	10R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	106 --- --- ---	10 --- --- ---	Douglas fir.
41, 42----- Chuckanut	13A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Western hemlock----- Red alder----- Western redcedar-----	130 --- --- ---	13 --- --- ---	Douglas fir, red alder.
43----- Chuckanut	13R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar-----	130 --- --- ---	13 --- --- ---	Douglas fir, red alder.
44, 45----- Cinebar	17A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Red alder----- Western hemlock----- Bigleaf maple----- Western redcedar-----	132 --- 110 --- ---	13 --- 17 --- ---	Douglas fir.
46----- Cinebar	17R	Moderate	Severe	Slight	Slight	Severe	Douglas fir----- Red alder----- Western hemlock----- Bigleaf maple----- Western redcedar-----	132 --- 110 --- ---	13 --- 17 --- ---	Douglas fir.
47----- Cotteral	13F	Slight	Moderate	Moderate	Moderate	Slight	Western hemlock----- Douglas fir----- Pacific silver fir-- Western redcedar----- Noble fir----- Alaska cedar----- Western white pine--	85 90 --- --- --- --- ---	13 8 --- --- --- --- ---	Douglas fir, noble fir, western hemlock, Pacific silver fir.
48----- Cotteral	7R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Western redcedar----- Noble fir-----	65 --- --- ---	7 --- --- ---	Noble fir, western hemlock, Pacific silver fir.
49----- Crinker	12R	Moderate	Severe	Moderate	Moderate	Moderate	Western hemlock----- Pacific silver fir--	83 ---	12 ---	Western hemlock, noble fir, Pacific silver fir.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
50----- Cryofluvents	11W	Slight	Moderate	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Western redcedar---- Douglas fir----- Alaska cedar-----	80 --- --- --- --- ---	11 --- --- --- --- ---	Western hemlock, noble fir.
52----- Dobbs	15D	Slight	Moderate	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Pacific silver fir-- Noble fir-----	110 100 --- ---	10 15 --- ---	Douglas fir, western hemlock, Pacific silver fir.
53----- Edgewick	12W	Slight	Moderate	Moderate	Slight	Severe	Douglas fir----- Red alder----- Western redcedar----	125 --- ---	12 --- ---	Douglas fir, red alder.
54----- Elwell	17D	Slight	Moderate	Slight	Moderate	Moderate	Western hemlock----- Douglas fir----- Western redcedar---- Red alder----- Bigleaf maple-----	105 124 --- --- ---	17 12 --- --- ---	Western hemlock, Douglas fir, red alder.
55----- Elwell	17R	Moderate	Severe	Slight	Moderate	Moderate	Western hemlock----- Douglas fir----- Western redcedar---- Red alder----- Bigleaf maple-----	105 124 --- --- ---	17 12 --- --- ---	Western hemlock, Douglas fir, red alder.
56, 57, 58, 59----- Ethanias	8R	Moderate	Severe	Severe	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar-----	70 --- --- ---	8 --- --- ---	Western hemlock, noble fir, Pacific silver fir.
60----- Ethanias	8F	Slight	Moderate	Severe	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar-----	70 --- --- ---	8 --- --- ---	Noble fir, western hemlock, Pacific silver fir.
61----- Foss	8X	Slight	Moderate	Moderate	Slight	Moderate	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir-----	70 --- --- ---	8 --- --- ---	Noble fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
62----- Foss	8R	Moderate	Severe	Moderate	Slight	Moderate	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir-----	70 --- --- ---	8 --- --- ---	Noble fir, western hemlock.
63----- Gallup	10N	Slight	Moderate	Moderate	Slight	Moderate	Western hemlock----- Pacific silver fir-- Douglas fir-----	75 --- ---	10 --- ---	Western hemlock, noble fir.
64, 65----- Gallup	10R	Moderate	Severe	Moderate	Slight	Moderate	Western hemlock----- Pacific silver fir-- Douglas fir-----	75 --- ---	10 --- ---	Western hemlock, noble fir.
66, 67----- Getchell	14D	Slight	Moderate	Slight	Moderate	Moderate	Western hemlock----- Pacific silver fir-- Douglas fir----- Western redcedar----	91 --- --- ---	14 --- --- ---	Western hemlock, Pacific silver fir.
68----- Getchell	14R	Moderate	Severe	Slight	Moderate	Moderate	Western hemlock----- Pacific silver fir-- Douglas fir----- Western redcedar----	91 --- --- ---	14 --- --- ---	Western hemlock, Pacific silver fir.
69----- Greenwater	18S	Slight	Slight	Severe	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar---- Bigleaf maple-----	117 114 --- --- ---	11 18 --- --- ---	Douglas fir, red alder.
70----- Grotto	8S	Slight	Moderate	Moderate	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar----	90 --- --- ---	8 --- --- ---	Douglas fir, western hemlock.
71----- Hartnit	10D	Slight	Moderate	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Western redcedar---- Douglas fir-----	75 --- --- ---	10 --- --- ---	Western hemlock, Pacific silver fir.
72----- Haywire	7D	Slight	Moderate	Moderate	Moderate	Moderate	Western hemlock----- Pacific silver fir-- Noble fir-----	59 --- ---	7 --- ---	Noble fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Common trees	Site index	Produc-tivity class*	
73----- Haywire	7R	Moderate	Severe	Moderate	Moderate	Moderate	Western hemlock----- Pacific silver fir-- Noble fir-----	59 --- ---	7 --- ---	Noble fir, western hemlock.
74----- Haywire	7D	Slight	Moderate	Moderate	Moderate	Moderate	Western hemlock----- Pacific silver fir-- Noble fir-----	59 --- ---	7 --- ---	Noble fir, western hemlock.
75----- Haywire	7R	Moderate	Severe	Moderate	Moderate	Moderate	Western hemlock----- Pacific silver fir-- Noble fir-----	59 --- ---	7 --- ---	Noble fir, western hemlock.
76----- Hinker	7D	Slight	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Alaska cedar----- Mountain hemlock----	65 --- --- ---	7 --- --- ---	Western hemlock, Pacific silver fir.
77, 78----- Hinker	7R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Alaska cedar----- Mountain hemlock----	65 --- --- ---	7 --- --- ---	Western hemlock, Pacific silver fir.
79----- Humaquepts	6W	Slight	Severe	Severe	Severe	Severe	Red alder----- Western redcedar---- Sitka spruce----- Black cottonwood---- Western hemlock-----	85 --- --- --- ---	6 --- --- --- ---	Western redcedar, Sitka spruce, red alder.
80----- Index	11F	Slight	Moderate	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir----- Alaska cedar-----	81 --- --- --- ---	11 --- --- --- ---	Western hemlock, noble fir.
81, 82----- Index	11R	Moderate	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir----- Alaska cedar-----	81 --- --- --- ---	11 --- --- --- ---	Western hemlock, noble fir.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Common trees	Site index	Produc-tivity class*	
83**: Index-----	11R	Severe	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir----- Alaska cedar-----	81 --- --- --- ---	11 --- --- --- ---	Western hemlock, noble fir.
Rock outcrop.										
84----- Jonas	18A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar----	121 110 --- --- ---	12 18 --- --- ---	Douglas fir, western hemlock.
85----- Jonas	18R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar----	121 110 --- --- ---	12 18 --- --- ---	Douglas fir, western hemlock.
86----- Jonas	18A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar----	121 110 --- --- ---	12 18 --- --- ---	Douglas fir, western hemlock, red alder.
87, 88----- Jonas	18R	Moderate	Severe	Slight	Slight	Severe	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar----	121 110 --- --- ---	12 18 --- --- ---	Douglas fir, western hemlock.
89----- Kaleetan	11A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar---- Red alder-----	113 --- --- ---	11 --- --- ---	Douglas fir, western hemlock.
90----- Kaleetan	11R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar---- Red alder-----	113 --- --- ---	11 --- --- ---	Douglas fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
91----- Kaleetan	8R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	90 --- --- ---	8 --- --- ---	Douglas fir, western hemlock.
92----- Kaleetan	13A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	109 105 --- ---	10 13 --- ---	Douglas fir, western hemlock.
93----- Kaleetan	13R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	109 105 --- ---	10 13 --- ---	Douglas fir, western hemlock.
94----- Kaleetan	11A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	113 --- --- ---	11 --- --- ---	Douglas fir, western hemlock.
95----- Kaleetan	11R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	113 --- --- ---	11 --- --- ---	Douglas fir, western hemlock.
96----- Kanaskat	10A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	113 --- --- --- ---	10 --- --- --- ---	Douglas fir.
97----- Kanaskat	10R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	113 --- --- --- ---	10 --- --- --- ---	Douglas fir.
98----- Kanaskat	10A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	113 --- --- --- ---	10 --- --- --- ---	Douglas fir.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
99----- Kanaskat	10R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	113 --- --- --- ---	10 --- --- --- ---	Douglas fir.
100, 101----- Kapowsin	12D	Slight	Moderate	Slight	Moderate	Severe	Douglas fir----- Red alder----- Western redcedar----- Western hemlock----- Bigleaf maple-----	123 --- --- --- ---	12 --- --- --- ---	Douglas fir, red alder.
102----- Kapowsin	12R	Moderate	Severe	Slight	Moderate	Severe	Douglas fir----- Red alder----- Western redcedar----- Western hemlock----- Bigleaf maple-----	123 --- --- --- ---	12 --- --- --- ---	Douglas fir, red alder.
103, 104----- Kindy	15D	Slight	Moderate	Slight	Moderate	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Western redcedar----	96 95 --- ---	15 8 --- ---	Western hemlock, Pacific silver fir.
105----- Kindy	15R	Moderate	Severe	Slight	Moderate	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Western redcedar----	96 95 --- ---	15 8 --- ---	Western hemlock, Pacific silver fir.
106----- Klaber	7W	Slight	Severe	Severe	Severe	Severe	Red alder----- Douglas fir----- Western redcedar----- Bigleaf maple----- Oregon ash-----	90 --- --- --- ---	7 --- --- --- ---	Red alder, western redcedar.
107**: Klaber-----	7W	Slight	Severe	Severe	Severe	Severe	Red alder----- Douglas fir----- Western redcedar----- Bigleaf maple----- Oregon ash-----	90 --- --- --- ---	7 --- --- --- ---	Red alder, western redcedar.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
107**: Cinebar-----	17A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Red alder----- Western hemlock----- Bigleaf maple----- Western redcedar----	132 --- 110 --- ---	13 --- 17 --- ---	Douglas fir.
108----- Klapatche	10F	Slight	Moderate	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir----- Alaska cedar-----	72 --- --- --- ---	10 --- --- --- ---	Noble fir, western hemlock.
109----- Klapatche	10R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir----- Alaska cedar-----	72 --- --- --- ---	10 --- --- --- ---	Noble fir, western hemlock.
110**: Klapatche-----	10R	Severe	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir----- Alaska cedar-----	72 --- --- --- ---	10 --- --- --- ---	Noble fir, western hemlock.
Rock outcrop.										
111, 112----- Klaus	10D	Slight	Moderate	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----	111 --- ---	10 --- ---	Douglas fir.
113----- Klaus	10R	Moderate	Severe	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----	111 --- ---	10 --- ---	Douglas fir.
114----- Klaus	8D	Slight	Moderate	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----	92 --- ---	8 --- ---	Douglas fir.
115----- Klaus	8R	Moderate	Severe	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----	92 --- ---	8 --- ---	Douglas fir.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
116----- Larrupin	8S	Slight	Moderate	Moderate	Slight	Slight	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	95 --- --- ---	8 --- --- ---	Douglas fir.
117----- Larrupin	8R	Moderate	Severe	Moderate	Slight	Slight	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	95 --- --- ---	8 --- --- ---	Douglas fir.
118----- Larrupin	17A	Slight	Moderate	Slight	Slight	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Red alder----- Western redcedar----	105 --- --- --- ---	17 --- --- --- ---	Western hemlock, Douglas fir.
119----- Lemolo	18W	Slight	Severe	Severe	Severe	Severe	Western hemlock----- Red alder----- Douglas fir----- Sitka spruce----- Western redcedar----	113 90 --- --- ---	18 7 --- --- ---	Western hemlock, red alder.
120----- Littlejohn	10F	Slight	Moderate	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir--	110 --- --- ---	10 --- --- ---	Douglas fir, western hemlock.
121----- Littlejohn	10R	Moderate	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir--	110 --- --- ---	10 --- --- ---	Douglas fir, western hemlock.
122----- Littlejohn	8R	Moderate	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir--	90 --- --- ---	8 --- --- ---	Douglas fir, western hemlock.
123----- Littlejohn	10F	Slight	Moderate	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir--	110 --- --- ---	10 --- --- ---	Douglas fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
124----- Littlejohn	10R	Moderate	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir--	110 --- --- ---	10 --- --- ---	Douglas fir, western hemlock.
125----- Littlejohn	8R	Moderate	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir--	90 --- --- ---	8 --- --- ---	Douglas fir, western hemlock.
126**: Littlejohn-----	10R	Moderate	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir--	110 --- --- ---	10 --- --- ---	Douglas fir, western hemlock.
Rock outcrop.										
127----- Lynnwood	11S	Slight	Slight	Moderate	Slight	Moderate	Douglas fir----- Red alder----- Western hemlock----- Western redcedar----- Bigleaf maple-----	121 --- --- --- ---	11 --- --- --- ---	Douglas fir, red alder.
128----- Marblemount	12F	Slight	Moderate	Moderate	Moderate	Slight	Western hemlock----- Douglas fir----- Pacific silver fir-- Western redcedar----	85 107 --- ---	12 9 --- ---	Western hemlock, Douglas fir, Pacific silver fir.
129, 130----- Marblemount	12R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Douglas fir----- Pacific silver fir-- Western redcedar----	85 107 --- ---	12 9 --- ---	Western hemlock, Douglas fir, Pacific silver fir.
131**: Marblemount-----	12R	Severe	Severe	Moderate	Moderate	Slight	Western hemlock----- Douglas fir----- Pacific silver fir-- Western redcedar----	85 107 --- ---	12 9 --- ---	Western hemlock, Douglas fir, Pacific silver fir.
Rock outcrop.										

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Common trees	Site index	Produc-tivity class*	
132----- Mashel	12A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Red alder----- Western hemlock----- Western redcedar----- Bigleaf maple-----	123 --- --- --- ---	12 --- --- --- ---	Douglas fir, red alder.
133----- Mashel	12R	Moderate	Severe	Slight	Slight	Severe	Douglas fir----- Red alder----- Western hemlock----- Western redcedar----- Bigleaf maple-----	123 --- --- --- ---	12 --- --- --- ---	Douglas fir, red alder.
134----- Melakwa	9D	Slight	Moderate	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	104 --- --- ---	9 --- --- ---	Douglas fir, western hemlock.
135----- Melakwa	9R	Moderate	Severe	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	104 --- --- ---	9 --- --- ---	Douglas fir, western hemlock.
136----- Melakwa	8R	Moderate	Severe	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	90 --- --- ---	8 --- --- ---	Douglas fir, western hemlock.
137----- Melakwa	9R	Moderate	Severe	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	104 --- --- ---	9 --- --- ---	Douglas fir, western hemlock.
138**: Melakwa-----	9R	Severe	Severe	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	104 --- --- ---	9 --- --- ---	Douglas fir, western hemlock.
Rock outcrop.										
139----- Mowich	12W	Slight	Moderate	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	121 --- --- ---	12 --- --- ---	Douglas fir.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
141----- Nagrom	11D	Slight	Moderate	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir--- Noble fir-----	77 --- ---	11 --- ---	Western hemlock, noble fir.
142----- Nagrom	11R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir--- Noble fir-----	77 --- ---	11 --- ---	Western hemlock, noble fir.
143----- Nagrom	13D	Slight	Moderate	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir--- Noble fir-----	90 --- ---	13 --- ---	Western hemlock, noble fir.
144----- Nagrom	13R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir--- Noble fir-----	90 --- ---	13 --- ---	Western hemlock, noble fir.
145**: Nagrom-----	11R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir--- Noble fir-----	77 --- ---	11 --- ---	Western hemlock, noble fir.
Rock outcrop.										
146, 147----- Nargar	13A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Red alder----- Western hemlock----- Western redcedar---	134 --- --- ---	13 --- --- ---	Western hemlock, Douglas fir, red alder.
148**: Nargar-----	13R	Moderate	Severe	Slight	Slight	Severe	Douglas fir----- Red alder----- Western hemlock----- Western redcedar---	134 --- --- ---	13 --- --- ---	Western hemlock, Douglas fir, red alder.
Pastik-----	20R	Moderate	Severe	Slight	Moderate	Severe	Douglas fir----- Red alder----- Western hemlock----- Western redcedar--- Bigleaf maple-----	132 --- 123 --- ---	13 --- 20 --- ---	Douglas fir, red alder.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
149----- National	12F	Slight	Slight	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder----- Black cottonwood-----	127 --- --- --- ---	12 --- --- --- ---	Douglas fir, red alder.
150----- Neilton	10F	Slight	Slight	Severe	Slight	Moderate	Douglas fir----- Grand fir----- Western hemlock----- Western redcedar-----	105 --- --- ---	10 --- --- ---	Douglas fir.
151----- Nimue	10F	Slight	Moderate	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar-----	71 --- --- ---	10 --- --- ---	Western hemlock, noble fir.
152, 153----- Nimue	10R	Moderate	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar-----	71 --- --- ---	10 --- --- ---	Western hemlock, noble fir.
154----- Nimue	10F	Slight	Moderate	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar-----	71 --- --- ---	10 --- --- ---	Western hemlock, noble fir.
155----- Nimue	10R	Moderate	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar-----	71 --- --- ---	10 --- --- ---	Western hemlock, noble fir.
156**: Nimue-----	10R	Moderate	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Alaska cedar-----	71 --- --- ---	10 --- --- ---	Western hemlock, noble fir.
Rock outcrop.										
157----- Nooksack	12W	Slight	Moderate	Moderate	Slight	Severe	Douglas fir----- Western redcedar----- Red alder-----	120 --- ---	12 --- ---	Douglas fir, red alder.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
158----- Norma	7W	Slight	Severe	Severe	Severe	Severe	Red alder----- Western redcedar---- Bigleaf maple----- Western hemlock-----	90 --- --- ---	7 --- --- ---	Red alder, western redcedar.
159, 160----- Oakes	16F	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar---- Red alder----- Bigleaf maple-----	117 105 --- --- ---	11 16 --- --- ---	Douglas fir, western hemlock, red alder.
161----- Oakes	16R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar---- Red alder----- Bigleaf maple-----	117 105 --- --- ---	11 16 --- --- ---	Douglas fir, western hemlock, red alder.
162----- Ogarty	19F	Slight	Slight	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar---- Bigleaf maple-----	117 113 --- --- ---	11 19 --- --- ---	Douglas fir, western hemlock, red alder.
163----- Ogarty	19R	Moderate	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar---- Bigleaf maple-----	117 113 --- --- ---	11 19 --- --- ---	Douglas fir, western hemlock, red alder.
164**: Ogarty-----	19R	Severe	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar---- Bigleaf maple-----	117 113 --- --- ---	11 19 --- --- ---	Douglas fir, western hemlock, red alder.
Rock outcrop.										
165----- Ohop	17W	Slight	Moderate	Severe	Severe	Moderate	Western hemlock----- Douglas fir----- Western redcedar---- Red alder-----	110 --- --- ---	17 --- --- ---	Douglas fir, western hemlock, black cottonwood.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
166----- Ohop	16F	Slight	Moderate	Moderate	Moderate	Slight	Douglas fir----- Western hemlock----- Red alder-----	127 108 ---	12 16 ---	Douglas fir, western hemlock.
167----- Olomount	18D	Slight	Moderate	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar----- Pacific silver fir-- Bigleaf maple-----	122 113 --- --- --- ---	11 18 --- --- --- ---	Douglas fir, western hemlock.
168----- Olomount	18R	Moderate	Severe	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar----- Pacific silver fir-- Bigleaf maple-----	122 113 --- --- --- ---	11 18 --- --- --- ---	Douglas fir, western hemlock.
169**: Olomount-----	18R	Moderate	Severe	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar----- Pacific silver fir-- Bigleaf maple-----	122 113 --- --- --- ---	11 18 --- --- --- ---	Douglas fir, western hemlock.
Rock outcrop.										
170----- Oridia	7W	Slight	Severe	Severe	Severe	Severe	Red alder----- Western redcedar----- Black cottonwood----	90 --- ---	7 --- ---	Red alder, western redcedar.
172----- Ovall	9F	Slight	Slight	Severe	Moderate	Moderate	Douglas fir----- Red alder----- Bigleaf maple----- Western hemlock-----	100 --- --- ---	9 --- --- ---	Douglas fir, red alder.
173----- Ovall	9R	Moderate	Severe	Severe	Moderate	Moderate	Douglas fir----- Red alder----- Bigleaf maple----- Western hemlock-----	100 --- --- ---	9 --- --- ---	Douglas fir, red alder.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
174----- Pastik	20W	Slight	Moderate	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Bigleaf maple----- Red alder-----	132 123 --- --- ---	13 20 --- --- ---	Douglas fir, red alder.
175----- Persis	18A	Slight	Moderate	Slight	Slight	Severe	Western hemlock----- Douglas fir----- Western redcedar----- Red alder-----	130 --- --- ---	18 --- --- ---	Douglas fir, western hemlock.
176----- Persis	15A	Slight	Moderate	Slight	Slight	Severe	Western hemlock----- Douglas fir----- Western redcedar----- Red alder-----	100 --- --- ---	15 --- --- ---	Douglas fir, western hemlock.
177----- Pheeny	13F	Slight	Moderate	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	101 85 --- --- ---	10 13 --- --- ---	Douglas fir, western hemlock.
178----- Pheeny	13R	Moderate	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	101 85 --- --- ---	10 13 --- --- ---	Douglas fir, western hemlock.
179----- Pheeny	13F	Slight	Moderate	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	101 85 --- --- ---	10 13 --- --- ---	Douglas fir, western hemlock.
180----- Pheeny	13R	Moderate	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	101 85 --- --- ---	10 13 --- --- ---	Douglas fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
181**: Pheeney-----	13R	Moderate	Severe	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar----	101 85 --- --- ---	10 13 --- --- ---	Douglas fir, western hemlock.
Rock outcrop.										
182----- Philippa	10D	Slight	Moderate	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar----	110 --- --- ---	10 --- --- ---	Douglas fir.
183----- Philippa	10R	Moderate	Severe	Slight	Moderate	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar----	110 --- --- ---	10 --- --- ---	Douglas fir.
184----- Pierking	15W	Slight	Moderate	Severe	Severe	Severe	Western hemlock----- Red alder----- Western redcedar----- Douglas fir----- Black cottonwood----- Grand fir----- Sitka spruce-----	102 100 --- --- --- --- ---	15 8 --- --- --- --- ---	Western hemlock, western redcedar, red alder.
185**: Pierking-----	15W	Slight	Moderate	Severe	Severe	Severe	Western hemlock----- Red alder----- Western redcedar----- Douglas fir----- Black cottonwood----- Grand fir----- Sitka spruce-----	102 100 --- --- --- --- ---	15 8 --- --- --- --- ---	Western hemlock, western redcedar, red alder.
Borohemists.										
Pierking-----	15W	Slight	Moderate	Severe	Severe	Severe	Western hemlock----- Red alder----- Western redcedar----- Douglas fir----- Black cottonwood----- Grand fir----- Sitka spruce-----	102 100 --- --- --- --- ---	15 8 --- --- --- --- ---	Western hemlock, western redcedar, red alder.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
186**: Mowich-----	12W	Slight	Moderate	Moderate	Moderate	Moderate	Douglas fir----- Western hemlock----- Western redcedar---- Red alder-----	121 --- --- ---	12 --- --- ---	Douglas fir.
187----- Pilchuck	11W	Slight	Moderate	Moderate	Slight	Moderate	Douglas fir----- Red alder----- Western hemlock----- Western redcedar---- Bigleaf maple----- Black cottonwood----	114 --- --- --- --- ---	11 --- --- --- --- ---	Douglas fir, red alder.
188----- Pitcher	11A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir-- Red alder-----	112 --- --- --- ---	11 --- --- --- ---	Douglas fir, western hemlock.
189----- Pitcher	11R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir-- Red alder-----	112 --- --- --- ---	11 --- --- --- ---	Douglas fir, western hemlock.
190----- Pitcher	9R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir-- Red alder-----	100 --- --- --- ---	9 --- --- --- ---	Douglas fir, western hemlock.
191----- Pitcher	11A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir-- Red alder-----	112 --- --- --- ---	11 --- --- --- ---	Douglas fir, western hemlock.
192----- Pitcher	11R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir-- Red alder-----	112 --- --- --- ---	11 --- --- --- ---	Douglas fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
193----- Pitcher	9R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir-- Red alder-----	100 --- --- --- ---	9 --- --- --- ---	Douglas fir, western hemlock.
194**: Pitcher-----	11R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Noble fir----- Pacific silver fir-- Red alder-----	112 --- --- --- ---	11 --- --- --- ---	Douglas fir, western hemlock.
Rock outcrop.										
196----- Playco	14F	Slight	Moderate	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir-----	89 --- --- ---	14 --- --- ---	Western hemlock, noble fir.
197, 198----- Playco	14R	Moderate	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir-----	89 --- --- ---	14 --- --- ---	Western hemlock, noble fir.
199----- Playco	12F	Slight	Moderate	Severe	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir-----	79 --- --- ---	12 --- --- ---	Western hemlock, noble fir.
200----- Playco	12R	Moderate	Severe	Severe	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir-----	79 --- --- ---	12 --- --- ---	Western hemlock, noble fir.
201**: Playco-----	14R	Moderate	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir-----	89 --- --- ---	14 --- --- ---	Western hemlock, noble fir.
Rock outcrop.										

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
202----- Puget	7W	Slight	Severe	Severe	Severe	Severe	Red alder----- Black cottonwood---- Western redcedar----	90 --- ---	7 --- ---	Western redcedar, red alder.
203, 204----- Ragnar	13S	Slight	Moderate	Moderate	Slight	Moderate	Douglas fir----- Western hemlock---- Red alder----- Western redcedar----	126 --- --- ---	13 --- --- ---	Douglas fir, red alder.
205**: Ragnar-----	13S	Slight	Moderate	Moderate	Slight	Moderate	Douglas fir----- Western hemlock---- Red alder----- Western redcedar----	126 --- --- ---	13 --- --- ---	Douglas fir, red alder.
Lynnwood-----	11S	Slight	Slight	Moderate	Slight	Moderate	Douglas fir----- Red alder----- Western hemlock---- Western redcedar---- Bigleaf maple-----	121 --- --- --- ---	11 --- --- --- ---	Douglas fir, red alder.
206**: Ragnar-----	13R	Moderate	Severe	Moderate	Slight	Moderate	Douglas fir----- Western hemlock---- Red alder----- Western redcedar----	126 --- --- ---	13 --- --- ---	Douglas fir, red alder.
Lynnwood-----	11R	Moderate	Severe	Moderate	Slight	Moderate	Douglas fir----- Red alder----- Western hemlock---- Western redcedar---- Bigleaf maple-----	121 --- --- --- ---	11 --- --- --- ---	Douglas fir, red alder.
208**: Reggad.										
Haywire-----	7R	Severe	Severe	Moderate	Moderate	Moderate	Western hemlock----- Pacific silver fir-- Noble fir-----	59 --- ---	7 --- ---	Noble fir, western hemlock.
209**: Reggad.										

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
209**: Klapatche-----	10R	Severe	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Douglas fir----- Alaska cedar-----	72 --- --- --- ---	10 --- --- --- ---	Noble fir, western hemlock.
Rock outcrop.										
210**: Reggad.										
Serene-----	7R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Mountain hemlock----	65 --- --- ---	7 --- --- ---	Noble fir, western hemlock.
211----- Reichel	15A	Slight	Moderate	Slight	Slight	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar---- Alaska cedar-----	98 100 --- --- --- ---	15 9 --- --- --- ---	Western hemlock, noble fir, Pacific silver fir.
212----- Reichel	15R	Moderate	Severe	Slight	Slight	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar---- Alaska cedar-----	98 100 --- --- --- ---	15 9 --- --- --- ---	Western hemlock, noble fir, Pacific silver fir.
213----- Reichel	15A	Slight	Moderate	Slight	Slight	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar---- Alaska cedar-----	98 100 --- --- --- ---	15 9 --- --- --- ---	Western hemlock, noble fir, Pacific silver fir.
214----- Reichel	15R	Moderate	Severe	Slight	Slight	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar---- Alaska cedar-----	98 100 --- --- --- ---	15 9 --- --- --- ---	Western hemlock, noble fir, Pacific silver fir.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
216----- Rober	17W	Slight	Moderate	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	121 108 --- ---	11 17 --- ---	Douglas fir, western hemlock.
217----- Rober	17R	Moderate	Severe	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	121 108 --- ---	11 17 --- ---	Douglas fir, western hemlock.
219**: Rock outcrop.										
Cattcreek-----	13R	Severe	Severe	Moderate	Moderate	Slight	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar----- Western white pine-- Alaska cedar-----	86 90 --- --- --- --- ---	13 8 --- --- --- --- ---	Douglas fir, noble fir, western hemlock.
220**: Rock outcrop.										
Cayuse-----	6R	Severe	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Subalpine fir----- Engelmann spruce----	55 --- --- ---	6 --- --- ---	Noble fir, western hemlock.
221**: Rock outcrop.										
Haywire-----	7R	Severe	Severe	Moderate	Moderate	Moderate	Western hemlock----- Pacific silver fir-- Noble fir-----	59 --- ---	7 --- ---	Noble fir, western hemlock.
222**: Rock outcrop.										
Rubble land.										
Haywire-----	7R	Severe	Severe	Moderate	Moderate	Moderate	Western hemlock----- Pacific silver fir-- Noble fir-----	59 --- ---	7 --- ---	Noble fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
223**: Rock outcrop. Rubble land.										
Serene-----	7R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Mountain hemlock----	65 --- --- ---	7 --- --- ---	Noble fir, western hemlock.
225----- Rugles	13A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Western hemlock----- Red alder----- Black cottonwood----- Sitka spruce----- Western redcedar----	129 --- --- --- --- ---	13 --- --- --- --- ---	Douglas fir.
226----- Salal	11W	Slight	Moderate	Moderate	Slight	Severe	Douglas fir----- Western redcedar----- Western hemlock----- Red alder-----	115 --- --- ---	11 --- --- ---	Douglas fir, red alder.
227----- Sauk	13A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Bigleaf maple----- Red alder----- Western hemlock----- Western redcedar----	130 --- --- --- ---	13 --- --- --- ---	Douglas fir, red alder, western hemlock.
228, 229----- Scamman	11W	Slight	Moderate	Moderate	Severe	Severe	Douglas fir----- Red alder----- Western hemlock----- Western redcedar----- Bigleaf maple----- Bitter cherry----- Oregon ash-----	116 --- --- --- --- --- ---	11 --- --- --- --- --- ---	Douglas fir, red alder.
230----- Scamman	11R	Moderate	Severe	Moderate	Severe	Severe	Douglas fir----- Red alder----- Western hemlock----- Western redcedar----- Bigleaf maple----- Bitter cherry----- Oregon ash-----	116 --- --- --- --- --- ---	11 --- --- --- --- --- ---	Douglas fir, red alder.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
231----- Seattle	6W	Slight	Severe	Severe	Severe	Severe	Red alder----- Western redcedar---- Black cottonwood---- Sitka spruce-----	85 --- --- ---	6 --- --- ---	Red alder.
232----- Serene	7F	Slight	Moderate	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Mountain hemlock----	65 --- --- ---	7 --- --- ---	Noble fir, western hemlock.
233----- Serene	7R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Mountain hemlock----	65 --- --- ---	7 --- --- ---	Noble fir, western hemlock.
234**: Serene----- Rock outcrop.	7R	Moderate	Severe	Moderate	Moderate	Slight	Western hemlock----- Pacific silver fir-- Noble fir----- Mountain hemlock----	65 --- --- ---	7 --- --- ---	Noble fir, western hemlock.
235----- Shalcar	6W	Slight	Severe	Severe	Severe	Severe	Red alder----- Western redcedar---- Western hemlock----- Lodgepole pine----- Sitka spruce-----	85 --- --- --- ---	6 --- --- --- ---	Red alder, western redcedar.
236----- Si	12W	Slight	Moderate	Moderate	Moderate	Severe	Douglas fir----- Red alder----- Black cottonwood---- Western redcedar----	120 90 --- ---	12 7 --- ---	Douglas fir, red alder.
237----- Skykomish	16F	Slight	Moderate	Moderate	Slight	Moderate	Western hemlock----- Douglas fir----- Western redcedar---- Red alder-----	106 108 --- ---	16 10 --- ---	Douglas fir, western hemlock.
238----- Skykomish	16R	Moderate	Severe	Moderate	Slight	Moderate	Western hemlock----- Douglas fir----- Western redcedar---- Red alder-----	106 108 --- ---	16 10 --- ---	Douglas fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
239----- Skykomish	13F	Slight	Moderate	Moderate	Slight	Moderate	Western hemlock----- Douglas fir----- Western redcedar----- Red alder-----	85 --- --- ---	13 --- --- ---	Douglas fir, western hemlock.
240----- Skykomish	16F	Slight	Moderate	Moderate	Slight	Moderate	Western hemlock----- Douglas fir----- Western redcedar----- Red alder-----	106 108 --- ---	16 10 --- ---	Douglas fir, western hemlock.
241----- Snoqualmie	10S	Slight	Moderate	Severe	Slight	Moderate	Douglas fir----- Red alder----- Western hemlock----- Western redcedar----- Black cottonwood-----	110 --- --- --- ---	10 --- --- --- ---	Douglas fir, red alder.
242----- Snoqualmie	7S	Slight	Moderate	Severe	Slight	Moderate	Douglas fir----- Red alder----- Western hemlock----- Western redcedar----- Black cottonwood-----	85 --- --- --- ---	7 --- --- --- ---	Douglas fir, red alder.
243----- Spukwush	13F	Slight	Moderate	Moderate	Slight	Moderate	Western hemlock----- Pacific silver fir-- Douglas fir-----	90 --- ---	13 --- ---	Western hemlock, Pacific silver fir, Douglas fir.
244----- Stahl	14R	Moderate	Severe	Moderate	Moderate	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar-----	91 95 --- --- ---	14 8 --- --- ---	Western hemlock, Douglas fir, noble fir, Pacific silver fir.
245----- Stahl	14D	Slight	Moderate	Moderate	Moderate	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar-----	91 95 --- --- ---	14 8 --- --- ---	Western hemlock, Douglas fir, noble fir, Pacific silver fir.
246----- Stahl	14R	Moderate	Severe	Moderate	Moderate	Moderate	Western hemlock----- Douglas fir----- Pacific silver fir-- Noble fir----- Western redcedar-----	91 95 --- --- ---	14 8 --- --- ---	Western hemlock, Douglas fir, noble fir, Pacific silver fir.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
247----- Sulsavar	20A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	142 124 --- ---	14 20 --- ---	Douglas fir, red alder.
248----- Sultan	12W	Slight	Moderate	Slight	Moderate	Severe	Douglas fir----- Red alder----- Western redcedar-----	120 --- ---	12 --- ---	Douglas fir, red alder, western redcedar.
249----- Teneriffe	10F	Slight	Moderate	Moderate	Slight	Slight	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	110 --- --- --- ---	10 --- --- --- ---	Douglas fir.
250----- Teneriffe	10R	Moderate	Severe	Moderate	Slight	Slight	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	110 --- --- --- ---	10 --- --- --- ---	Douglas fir.
251, 252----- Teneriffe	10F	Slight	Moderate	Moderate	Slight	Slight	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	110 --- --- --- ---	10 --- --- --- ---	Douglas fir.
253----- Teneriffe	10R	Moderate	Severe	Moderate	Slight	Slight	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	110 --- --- --- ---	10 --- --- --- ---	Douglas fir.
254, 255, 256----- Tokul	19D	Slight	Moderate	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Red alder----- Bigleaf maple-----	130 117 --- --- ---	13 19 --- --- ---	Douglas fir, western hemlock, red alder.
257----- Tokul	19R	Moderate	Severe	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Red alder----- Bigleaf maple-----	130 117 --- --- ---	13 19 --- --- ---	Douglas fir, western hemlock, red alder.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Common trees	Site index	Produc-tivity class*	
258**: Tokul-----	19R	Severe	Severe	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Red alder----- Bigleaf maple-----	130 117 --- --- ---	13 19 --- --- ---	Douglas fir, western hemlock, red alder.
Pastik-----	20R	Moderate	Severe	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Bigleaf maple----- Red alder-----	132 123 --- --- ---	13 20 --- --- ---	Douglas fir, red alder.
259**: Tokul-----	10R	Severe	Severe	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Red alder----- Bigleaf maple-----	105 --- --- --- ---	10 --- --- --- ---	Douglas fir, western hemlock, red alder.
Pastik-----	10W	Slight	Moderate	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Bigleaf maple----- Red alder-----	105 --- --- --- ---	10 --- --- --- ---	Douglas fir, red alder.
261----- Tukwila	6W	Slight	Severe	Severe	Severe	Severe	Red alder----- Western redcedar----- Western hemlock----- Sitka spruce-----	85 --- --- ---	6 --- --- ---	Western redcedar, red alder.
262----- Tusip	13F	Slight	Moderate	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Douglas fir-----	90 --- ---	13 --- ---	Western hemlock.
263----- Tusip	13R	Moderate	Severe	Moderate	Slight	Slight	Western hemlock----- Pacific silver fir-- Douglas fir-----	90 --- ---	13 --- ---	Western hemlock.
264----- Typic Haplorthods	17R	Severe	Severe	Slight	Moderate	Severe	Douglas fir----- Western hemlock----- Bigleaf maple----- Western redcedar-----	115 105 --- ---	11 17 --- ---	Douglas fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
265----- Typic Udifluvents	12W	Slight	Moderate	Moderate	Slight	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	125 --- --- ---	12 --- --- ---	Douglas fir.
266----- Typic Udifluvents	8W	Slight	Moderate	Moderate	Slight	Severe	Douglas fir----- Western hemlock----- Western redcedar----- Red alder-----	90 --- --- ---	8 --- --- ---	Douglas fir.
267----- Udifluvents	19W	Slight	Moderate	Severe	Slight	Slight	Western hemlock----- Red alder----- Douglas fir----- Western redcedar-----	100 100 115 ---	19 10 11 ---	Western hemlock, Douglas fir.
268----- Vailton	16A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	113 103 --- --- ---	10 16 --- --- ---	Douglas fir, western hemlock, red alder.
269----- Vailton	16R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	113 103 --- --- ---	10 16 --- --- ---	Douglas fir, western hemlock, red alder.
270, 271----- Voight	16A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar----- Bigleaf maple-----	114 105 --- --- ---	11 16 --- --- ---	Douglas fir, western hemlock.
272----- Voight	16R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar----- Bigleaf maple-----	114 105 --- --- ---	11 16 --- --- ---	Douglas fir, western hemlock.
273----- Welcome	14A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar-----	106 89 --- ---	10 14 --- ---	Douglas fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Common trees	Site index	Productivity class*	
274----- Welcome	14R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Red alder----- Western redcedar----	106 89 --- ---	10 14 --- ---	Douglas fir, western hemlock.
275, 276----- Wilkeson	12A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Red alder----- Western hemlock----- Bigleaf maple----- Western redcedar----- Bitter cherry-----	122 --- --- --- --- ---	12 --- --- --- --- ---	Douglas fir, red alder.
277----- Wilkeson	12R	Moderate	Severe	Slight	Slight	Severe	Douglas fir----- Red alder----- Western hemlock----- Bigleaf maple----- Western redcedar----- Bitter cherry-----	122 --- --- --- --- ---	12 --- --- --- --- ---	Douglas fir, red alder.
278, 279----- Winston	18A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	125 114 --- --- ---	12 18 --- --- ---	Douglas fir, red alder.
280----- Winston	8A	Slight	Moderate	Slight	Slight	Severe	Douglas fir----- Western hemlock----- Red alder----- Bigleaf maple----- Western redcedar-----	90 --- --- --- ---	8 --- --- --- ---	Douglas fir, red alder.
281----- Woodinville	7W	Slight	Severe	Severe	Severe	Severe	Red alder----- Western redcedar----- Black cottonwood----	90 --- ---	7 --- ---	Red alder, western redcedar.
282----- Zynbar	17A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir----- Western hemlock----- Western redcedar----- Red alder----- Bigleaf maple-----	123 110 --- --- ---	12 17 --- --- ---	Douglas fir, western hemlock.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Produc- tivity class*	
283----- Zynbar	17R	Moderate	Severe	Slight	Slight	Moderate	Douglas fir-----	123	12	Douglas fir, western hemlock.
							Western hemlock----	110	17	
							Red alder-----	---	---	
							Western redcedar----	---	---	
							Bigleaf maple-----	---	---	
284----- Zynbar	17A	Slight	Moderate	Slight	Slight	Moderate	Douglas fir-----	123	12	Douglas fir, western hemlock.
							Western hemlock----	110	17	
							Red alder-----	---	---	
							Western redcedar----	---	---	
							Bigleaf maple-----	---	---	

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1----- Alderwood	Moderate: slope, small stones, wetness.	Moderate: slope, wetness, small stones.	Severe: slope, small stones.	Moderate: wetness.
2----- Alderwood	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: wetness, slope.
3----- Alkiridge	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: wetness, slope.
4----- Altapeak	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
5, 6----- Altapeak	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
7*: Altapeak-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
8----- Andic Cryumbrepts	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: slope, small stones.
9----- Arents	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
10----- Barneston	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
11----- Barneston	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
12----- Barneston	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
13----- Barneston	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
14----- Barneston	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
15----- Barneston	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
16----- Barneston	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
17----- Beausite	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
18, 19----- Beausite	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
20----- Belfast	Severe: flooding.	Moderate: dusty.	Moderate: flooding.	Moderate: dusty.
21----- Bellicum	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.
22----- Bellicum	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
23----- Blethen	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
24----- Blethen	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
25----- Borochemists	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
26----- Bromo	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
27, 28, 29, 30----- Cattcreek	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
31----- Cattcreek	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.
32----- Cayuse	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
33----- Cayuse	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
34----- Chinkmin	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Moderate: wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
35----- Chinkmin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: wetness, slope.
36----- Chinkmin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
37----- Chinkmin	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Moderate: wetness.
38----- Chinkmin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: wetness, slope.
39----- Christoff	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
40----- Christoff	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
41----- Chuckanut	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
42----- Chuckanut	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
43----- Chuckanut	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
44----- Cinebar	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
45----- Cinebar	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
46----- Cinebar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
47----- Cotteral	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.
48----- Cotteral	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
49----- Crinker	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
50----- Cryofluvents	Severe: flooding.	Moderate: small stones.	Severe: small stones.	Slight.
51----- Cryochemists	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
52----- Dobbs	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
53----- Edgewick	Severe: flooding.	Slight-----	Moderate: small stones, flooding.	Slight.
54----- Elwell	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: wetness, slope.
55----- Elwell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
56, 57, 58, 59----- Ethanias	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.
60----- Ethanias	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.
61----- Foss	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
62----- Foss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
63----- Gallup	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
64, 65----- Gallup	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
66----- Getchell	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Moderate: wetness.
67, 68----- Getchell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
69----- Greenwater	Severe: flooding.	Slight-----	Moderate: slope, small stones.	Slight.
70----- Grotto	Severe: flooding.	Moderate: too sandy, small stones.	Severe: small stones.	Moderate: too sandy.
71----- Hartnit	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
72----- Haywire	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
73----- Haywire	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
74----- Haywire	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
75----- Haywire	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
76----- Hinker	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
77, 78----- Hinker	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
79----- Humaquepts	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
80----- Index	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
81, 82----- Index	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
83*: Index-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
84----- Jonas	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
85----- Jonas	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
86----- Jonas	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
87, 88----- Jonas	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
89----- Kaleetan	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
90, 91----- Kaleetan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
92----- Kaleetan	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
93----- Kaleetan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
94----- Kaleetan	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
95----- Kaleetan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
96----- Kanaskat	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
97----- Kanaskat	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
98----- Kanaskat	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
99----- Kanaskat	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
100----- Kapowsin	Severe: wetness.	Moderate: slope, wetness, small stones.	Severe: slope, small stones, wetness.	Moderate: wetness.
101----- Kapowsin	Severe: slope, wetness.	Severe: slope.	Severe: slope, small stones, wetness.	Moderate: wetness, slope.
102----- Kapowsin	Severe: slope, wetness.	Severe: slope.	Severe: slope, small stones, wetness.	Severe: slope.
103----- Kindy	Moderate: small stones, wetness.	Moderate: wetness, small stones.	Severe: slope, small stones.	Moderate: wetness.
104----- Kindy	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: wetness, slope.
105----- Kindy	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
106----- Klaber	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
107*: Klaber-----	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Cinebar-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
108----- Klapatche	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
109----- Klapatche	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
110*: Klapatche----- Rock outcrop.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
111----- Klaus	Slight-----	Slight-----	Moderate: slope, cemented pan.	Slight.
112----- Klaus	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
113----- Klaus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
114----- Klaus	Slight-----	Slight-----	Moderate: slope, cemented pan.	Slight.
115----- Klaus	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
116----- Larrupin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
117----- Larrupin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
118----- Larrupin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
119----- Lemolo	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
120----- Littlejohn	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
121, 122----- Littlejohn	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
123----- Littlejohn	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
124, 125----- Littlejohn	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
126*: Littlejohn-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
126*: Rock outcrop.				
127----- Lynnwood	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
128----- Marblemount	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
129, 130----- Marblemount	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
131*: Marblemount----- Rock outcrop.	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
132----- Mashel	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
133----- Mashel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
134----- Melakwa	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
135, 136, 137----- Melakwa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
138*: Melakwa----- Rock outcrop.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
139----- Mowich	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.
140----- Mukilteo	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
141----- Nagrom	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
142----- Nagrom	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
143----- Nagrom	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
144----- Nagrom	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
145*: Nagrom-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
146----- Nargar	Slight-----	Slight-----	Severe: slope.	Slight.
147----- Nargar	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
148*: Nargar-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pastik-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
149----- National	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
150----- Neilton	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
151----- Nimue	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
152, 153----- Nimue	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
154----- Nimue	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
155----- Nimue	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
156*: Nimue-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
157----- Nooksack	Severe: flooding.	Moderate: dusty.	Moderate: flooding, dusty.	Moderate: dusty.
158----- Norma	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
159----- Oakes	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
160----- Oakes	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.
161----- Oakes	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.
162----- Ogarty	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
163----- Ogarty	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
164*: Ogarty-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
165----- Ohop	Moderate: wetness.	Moderate: wetness.	Moderate: slope, small stones, wetness.	Slight.
166----- Ohop	Moderate: wetness.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.
167----- Olomount	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
168----- Olomount	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
169*: Olomount-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
170----- Oridia	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
171*: Orthents-----	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: slope.
Humods-----	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.
172----- Ovall	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, dusty.
173----- Ovall	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
174----- Pastik	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: wetness, slope.
175, 176----- Persis	Slight-----	Slight-----	Moderate: slope.	Slight.
177----- Pheeney	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, dusty.
178----- Pheeney	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
179----- Pheeney	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, dusty.
180----- Pheeney	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
181*: Pheeney-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
182----- Philippa	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
183----- Philippa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
184----- Pierking	Severe: flooding, wetness.	Severe: wetness.	Severe: small stones, wetness.	Severe: wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
185*: Pierking-----	Severe: flooding, wetness.	Severe: wetness.	Severe: small stones, wetness.	Severe: wetness.
Borochemists-----	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
186*: Pierking-----	Severe: wetness.	Severe: wetness.	Severe: small stones, wetness.	Severe: wetness.
Mowich-----	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.
187----- Pilchuck	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight.
188----- Pitcher	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
189, 190----- Pitcher	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
191----- Pitcher	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
192, 193----- Pitcher	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
194*: Pitcher-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
195*----- Pits	Severe: small stones, too sandy.	Severe: too sandy, small stones.	Severe: small stones, too sandy.	Severe: too sandy, small stones.
196----- Playco	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
197, 198----- Playco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
199----- Playco	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.
200----- Playco	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
201*: Playco-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
202----- Puget	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
203----- Ragnar	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
204----- Ragnar	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
205*: Ragnar-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Lynnwood-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
206*: Ragnar-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lynnwood-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
207----- Reggad	Severe: slope, large stones, excess humus.	Severe: slope, large stones, excess humus.	Severe: large stones, slope, excess humus.	Severe: large stones, excess humus, slope.
208*: Reggad-----	Severe: slope, large stones, excess humus.	Severe: slope, large stones, excess humus.	Severe: large stones, slope, excess humus.	Severe: large stones, excess humus, slope.
Haywire-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
209*: Reggad-----	Severe: slope, large stones, excess humus.	Severe: slope, large stones, excess humus.	Severe: large stones, slope, excess humus.	Severe: large stones, excess humus, slope.
Klapatche-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
210*: Reggad-----	Severe: slope, large stones, excess humus.	Severe: slope, large stones, excess humus.	Severe: large stones, slope, excess humus.	Severe: large stones, excess humus, slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
210*: Serene-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
211----- Reichel	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
212----- Reichel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
213----- Reichel	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
214----- Reichel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
215*----- Riverwash	Severe: flooding, small stones, wetness.	Severe: wetness, too sandy, small stones.	Severe: small stones, too sandy, wetness.	Severe: wetness, too sandy, small stones.
216----- Rober	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
217----- Rober	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
218*. Rock outcrop				
219*: Rock outcrop.				
Cattcreek-----	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
220*: Rock outcrop.				
Cayuse-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
221*: Rock outcrop.				
Haywire-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
222*: Rock outcrop.				
Rubble land-----	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.
Haywire-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
223*: Rock outcrop.				
Rubble land-----	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.
Serene-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
224*----- Rubble land	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.
225----- Rugles	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight.
226----- Salal	Severe: flooding.	Slight-----	Moderate: flooding.	Slight.
227----- Sauk	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
228----- Scamman	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.
229----- Scamman	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: wetness.
230----- Scamman	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: wetness, slope.
231----- Seattle	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
232----- Serene	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
233----- Serene	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
234*: Serene-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
235----- Shalcar	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
236----- Si	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight.
237----- Skykomish	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
238----- Skykomish	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
239----- Skykomish	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
240----- Skykomish	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.
241, 242----- Snoqualmie	Severe: flooding.	Slight-----	Moderate: slope, small stones.	Slight.
243----- Spukwush	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
244----- Stahl	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
245----- Stahl	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.
246----- Stahl	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
247----- Sulsavar	Severe: flooding.	Slight-----	Moderate: slope, small stones.	Slight.
248----- Sultan	Severe: flooding.	Moderate: wetness, dusty.	Moderate: wetness, dusty.	Moderate: dusty.
249----- Teneriffe	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
250----- Teneriffe	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
251, 252----- Teneriffe	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.
253----- Teneriffe	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
254----- Tokul	Moderate: small stones, wetness.	Moderate: wetness, small stones.	Severe: small stones.	Moderate: wetness.
255----- Tokul	Moderate: slope, small stones, wetness.	Moderate: slope, wetness, small stones.	Severe: slope, small stones.	Moderate: wetness.
256----- Tokul	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: wetness, slope.
257----- Tokul	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
258*, 259*: Tokul-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Pastik-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
260----- Treen	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
261----- Tukwila	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
262----- Tusip	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
263----- Tusip	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
264----- Typic Haplorthods	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
265, 266----- Typic Udifluvents	Severe: flooding.	Slight-----	Moderate: flooding.	Slight.
267----- Udifluvents	Severe: flooding.	Moderate: small stones.	Severe: small stones.	Slight.
268----- Vailton	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
269----- Vailton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
270----- Voight	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
271----- Voight	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
272----- Voight	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
273----- Welcome	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
274----- Welcome	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
275----- Wilkeson	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope, small stones.	Moderate: dusty.
276----- Wilkeson	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, dusty.
277----- Wilkeson	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
278----- Winston	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
279, 280----- Winston	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
281----- Woodinville	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.
282----- Zynbar	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
283----- Zynbar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
284----- Zynbar	Slight-----	Slight-----	Severe: slope.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hard-wood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
1, 2----- Alderwood	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
3----- Alkiridge	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
4, 5, 6----- Altapeak	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
7*: Altapeak-----	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.											
8----- Andic Cryumbrepts	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
9----- Arents	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
10, 11----- Barneston	Fair	Fair	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
12----- Barneston	Poor	Poor	Fair	Fair	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
13, 14----- Barneston	Fair	Fair	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
15----- Barneston	Poor	Poor	Fair	Fair	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
16----- Barneston	Fair	Fair	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
17----- Beausite	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
18----- Beausite	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
19----- Beausite	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
20----- Belfast	Fair	Fair	Good	Good	Good	Good	Poor	Fair	Fair	Good	Poor.
21, 22----- Bellicum	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
23----- Blethen	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
24----- Blethen	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
25----- Borochemists	Very poor.	Poor	Good	Very poor.	Very poor.	Poor	Good	Fair	Poor	---	Fair.
26----- Bromo	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
27----- Cattcreek	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
28----- Cattcreek	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
29----- Cattcreek	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
30----- Cattcreek	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
31----- Cattcreek	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
32, 33----- Cayuse	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
34----- Chinkmin	Poor	Poor	Fair	Poor	Fair	Fair	Poor	Very poor.	Poor	Fair	Poor.
35----- Chinkmin	Poor	Poor	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
36----- Chinkmin	Very poor.	Very poor.	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
37----- Chinkmin	Poor	Poor	Fair	Poor	Fair	Fair	Poor	Very poor.	Poor	Fair	Poor.
38----- Chinkmin	Poor	Poor	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
39----- Christoff	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
40----- Christoff	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
41, 42----- Chuckanut	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
43----- Chuckanut	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
44, 45----- Cinebar	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
46----- Cinebar	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
47, 48----- Cotteral	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
49----- Crinker	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
50----- Cryofluvents	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
51----- Cryochemists	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor	Good	Good	Very poor.	Poor	Good.
52----- Dobbs	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
53----- Edgewick	Fair	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
54----- Elwell	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
55----- Elwell	Very poor.	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
56, 57, 58, 59----- Ethanla	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
60----- Ethanla	Very poor.	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
61, 62----- Foss	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
63, 64, 65----- Gallup	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
66, 67, 68----- Getchell	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
69----- Greenwater	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
70----- Grotto	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
71----- Hartnit	Very poor.	Poor	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
72----- Haywire	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
73----- Haywire	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
74----- Haywire	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
75----- Haywire	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hard-wood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
76, 77, 78----- Hinker	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.
79----- Humaquepts	Poor	Poor	Fair	Fair	Fair	Fair	Good	Poor	Poor	Fair	Fair.
80, 81, 82----- Index	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
83*: Index-----	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.											
84----- Jonas	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
85----- Jonas	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
86, 87----- Jonas	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
88----- Jonas	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
89, 90, 91, 92, 93, 94, 95----- Kaleetan	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
96----- Kanaskat	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
97----- Kanaskat	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
98----- Kanaskat	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
99----- Kanaskat	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
100, 101----- Kapowsin	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
102----- Kapowsin	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
103----- Kindy	Poor	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
104, 105----- Kindy	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
106----- Klaber	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
107*: Klaber-----	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Poor.
Cinebar-----	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
108----- Klapatche	Poor	Poor	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
109----- Klapatche	Very poor.	Poor	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
110*: Klapatche-----	Very poor.	Poor	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.											
111, 112----- Klaus	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
113----- Klaus	Very poor.	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
114----- Klaus	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
115----- Klaus	Very poor.	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
116----- Larrupin	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.
117----- Larrupin	Very poor.	Very poor.	Good	Fair	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.
118----- Larrupin	Fair	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
119----- Lemolo	Poor	Poor	Good	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
120, 121, 122, 123, 124, 125----- Littlejohn	Poor	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
126*: Littlejohn-----	Very poor.	Poor	Good	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.											
127----- Lynnwood	Poor	Poor	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
128, 129, 130----- Marblemount	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
131*: Marblemount----- Rock outcrop.	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
132----- Mashel	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
133----- Mashel	Very poor.	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
134----- Melakwa	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
135, 136, 137----- Melakwa	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
138*: Melakwa----- Rock outcrop.	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
139----- Mowich	Fair	Good	Good	---	Good	Good	Poor	Very poor.	Good	Good	Very poor.
140----- Mukilteo	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	---	Good.
141, 142----- Nagrom	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
143, 144----- Nagrom	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
145*: Nagrom----- Rock outcrop.	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
146----- Nargar	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
147----- Nargar	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
148*: Nargar----- Pastik-----	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
149----- National	Fair	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hard-wood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
150----- Neilton	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
151, 152, 153, 154, 155----- Nimue	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
156*: Nimue-----	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.											
157----- Nooksack	Fair	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
158----- Norma	Poor	Poor	Fair	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair.
159, 160----- Oakes	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
161----- Oakes	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
162, 163----- Ogarty	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
164*: Ogarty-----	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.											
165, 166----- Ohop	Poor	Poor	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
167, 168----- Olomount	Poor	Fair	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.
169*: Olomount-----	Very poor.	Very poor.	Good	Fair	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.											
170----- Oridia	Good	Good	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
171*: Orthents-----	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Humods-----	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hard-wood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
172, 173----- Ovall	Poor	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
174----- Pastik	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
175, 176----- Persis	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
177, 178----- Pheeney	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
179----- Pheeney	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
180----- Pheeney	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
181*: Pheeney-----	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Rock outcrop.											
182----- Philippa	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
183----- Philippa	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
184----- Pierking	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
185*: Pierking-----	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Borohemists-----	Very poor.	Poor	Good	Very poor.	Very poor.	Poor	Good	Fair	Poor	---	Fair.
186*: Pierking-----	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Mowich-----	Fair	Good	Good	---	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
187----- Pilchuck	Poor	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
188----- Pitcher	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hard-wood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
189, 190----- Pitcher	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
191----- Pitcher	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
192, 193----- Pitcher	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
194*: Pitcher-----	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.											
195*----- Pits	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
196, 197, 198----- Playco	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
199, 200----- Playco	Very poor.	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.
201*: Playco-----	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.											
202----- Puget	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good	Fair	Fair.
203, 204----- Ragnar	Fair	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
205*: Ragnar-----	Fair	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Lynnwood-----	Poor	Poor	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
206*: Ragnar-----	Poor	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Lynnwood-----	Very poor.	Poor	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
207----- Reggad	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
208*: Reggad-----	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hard-wood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
208*: Haywire-----	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
209*: Reggad-----	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Klapatche-----	Very poor.	Poor	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.											
210*: Reggad-----	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Serene-----	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
211, 212----- Reichel	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
213, 214----- Reichel	Poor	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.
215*----- Riverwash	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor.
216----- Rober	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
217----- Rober	Very poor.	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
218*. Rock outcrop											
219*: Rock outcrop.											
Cattcreek-----	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
220*: Rock outcrop.											
Cayuse-----	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
221*: Rock outcrop.											
Haywire-----	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
222*: Rock outcrop.											
Rubble land-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Haywire-----	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
223*: Rock outcrop.											
Rubble land-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Serene-----	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
224*----- Rubble land	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
225----- Rugles	Fair	Good	Good	---	Good	Good	Poor	Very poor.	Good	Good	Very poor.
226----- Salal	Fair	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
227----- Sauk	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
228, 229----- Scamman	Fair	Fair	Good	---	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
230----- Scamman	Poor	Fair	Good	---	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
231----- Seattle	Poor	Fair	Fair	Poor	Fair	Fair	Good	Good	Fair	Fair	Good.
232, 233----- Serene	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
234*: Serene-----	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.											
235----- Shalcar	Poor	Poor	Good	Fair	Good	Good	Good	Good	Fair	Good	Good.
236----- Si	Fair	Fair	Good	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
237----- Skykomish	Fair	Fair	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hard-wood trees	Conif-erous plants	Shrubs	Wetland plants	Shallow water areas	Open-land wild-life	Wood-land wild-life	Wetland wild-life
238----- Skykomish	Poor	Poor	Good	Fair	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.
239----- Skykomish	Fair	Fair	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.
240----- Skykomish	Poor	Poor	Good	Fair	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.
241, 242----- Snoqualmie	Poor	Poor	Fair	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
243----- Spukwush	Poor	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
244----- Stahl	Very poor.	Very poor.	Good	Fair	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.
245----- Stahl	Poor	Poor	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.
246----- Stahl	Very poor.	Very poor.	Good	Fair	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.
247----- Sulsavar	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
248----- Sultan	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
249----- Teneriffe	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
250----- Teneriffe	Very poor.	Very poor.	Good	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
251, 252----- Teneriffe	Fair	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
253----- Teneriffe	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
254, 255, 256----- Tokul	Fair	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
257----- Tokul	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
258*, 259*: Tokul-----	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Pastik-----	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
260----- Treen	Very poor.	Poor	Fair	---	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
261----- Tukwila	Poor	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life
262, 263----- Tusip	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
264----- Typic Haplorthods	Very poor.	Very poor.	Good	Good	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
265, 266----- Typic Udifluvents	Fair	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
267----- Udifluvents	Fair	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
268, 269----- Vailton	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
270, 271----- Voight	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
272----- Voight	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
273----- Welcome	Fair	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
274----- Welcome	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
275, 276----- Wilkeson	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
277----- Wilkeson	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
278----- Winston	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
279, 280----- Winston	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
281----- Woodinville	Good	Good	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
282----- Zynbar	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
283----- Zynbar	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
284----- Zynbar	Poor	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1----- Alderwood	Severe: wetness.	Moderate: wetness, slope, large stones.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope, large stones.	Moderate: small stones, wetness, slope.
2----- Alderwood	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
3----- Alkiridge	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
4, 5, 6----- Altapeak	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
7*: Altapeak----- Rock outcrop.	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
8----- Andic Cryumbrepts	Severe: depth to rock, large stones, slope.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, slope.
9----- Arents	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Severe: droughty.
10----- Barneston	Severe: cutbanks cave.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: small stones, large stones.
11, 12----- Barneston	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
13----- Barneston	Severe: cutbanks cave.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: large stones.	Moderate: small stones, large stones.
14, 15, 16----- Barneston	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
17, 18, 19----- Beausite	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
20----- Belfast	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
21, 22----- Bellicum	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: small stones, slope.
23, 24----- Blethen	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
25----- Borohemists	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
26----- Bromo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: small stones, slope.
27, 28----- Cattcreek	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
29, 30----- Cattcreek	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
31----- Cattcreek	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
32, 33----- Cayuse	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
34----- Chinkmin	Severe: wetness.	Moderate: wetness, large stones.	Severe: wetness.	Moderate: wetness, slope, large stones.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
35, 36----- Chinkmin	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
37----- Chinkmin	Severe: wetness.	Moderate: wetness, large stones.	Severe: wetness.	Moderate: wetness, slope, large stones.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
38----- Chinkmin	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
39, 40----- Christoff	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
41----- Chuckanut	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
42, 43----- Chuckanut	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
44----- Cinebar	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
45, 46----- Cinebar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
47, 48----- Cotteral	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
49----- Crinker	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
50----- Cryofluvents	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty.
51----- Cryohemists	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
52----- Dobbs	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
53----- Edgewick	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
54, 55----- Elwell	Severe: cutbanks cave, wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
56, 57, 58, 59---- Ethanias	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
60----- Ethanias	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
61, 62----- Foss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
63, 64, 65----- Gallup	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
66----- Getchell	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: frost action.	Moderate: wetness, slope.
67, 68----- Getchell	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
69----- Greenwater	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
70----- Grotto	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: small stones, droughty.
71----- Hartnit	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
72, 73, 74, 75---- Haywire	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
76, 77, 78----- Hinker	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
79----- Humaquepts	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, frost action.	Severe: wetness.
80, 81, 82----- Index	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
83*: Index----- Rock outcrop.	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
84, 85, 86, 87, 88----- Jonas	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
89, 90, 91, 92, 93, 94, 95----- Kaleetan	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
96, 97, 98, 99---- Kanaskat	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
100----- Kapowsin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Moderate: wetness, slope.	Moderate: small stones, wetness, slope.
101, 102----- Kapowsin	Severe: wetness, slope.	Severe: wetness, slope.	Severe: wetness, slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.
103----- Kindy	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Moderate: small stones, large stones.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
104, 105----- Kindy	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
106----- Klaber	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
107*: Klaber-----	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
Cinebar-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Severe: low strength.	Slight.
108, 109----- Klapatche	Severe: depth to rock, cutbanks cave, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
110*: Klapatche-----	Severe: depth to rock, cutbanks cave, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Rock outcrop.						
111----- Klaus	Severe: cutbanks cave.	Slight-----	Moderate: cemented pan.	Moderate: slope.	Slight-----	Moderate: droughty, cemented pan.
112----- Klaus	Severe: cutbanks cave.	Moderate: slope.	Moderate: cemented pan, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, cemented pan.
113----- Klaus	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
114----- Klaus	Severe: cutbanks cave.	Slight-----	Moderate: cemented pan.	Moderate: slope.	Slight-----	Moderate: droughty, cemented pan.
115----- Klaus	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
116, 117----- Larrupin	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
118----- Larrupin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
119----- Lemolo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
120, 121, 122, 123, 124, 125---- Littlejohn	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
126*: Littlejohn-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
127----- Lynnwood	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
128, 129, 130----- Marblemount	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
131*: Marblemount-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
132, 133----- Mashel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
134, 135, 136, 137----- Melakwa	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
138*: Melakwa-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
139----- Mowich	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
140----- Mukilteo	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: ponding, excess humus.
141, 142----- Nagrom	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
143, 144----- Nagrom	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
145*: Nagrom----- Rock outcrop.	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
146----- Nargar	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
147----- Nargar	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
148*: Nargar----- Pastik-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
149----- National	Severe: cutbanks cave.	Slight-----	Moderate: wetness.	Moderate: slope.	Slight-----	Moderate: small stones.
150----- Neilton	Severe: cutbanks cave.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, large stones.	Severe: droughty.
151, 152, 153, 154, 155----- Nimue	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
156*: Nimue----- Rock outcrop.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
157----- Nooksack	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
158----- Norma	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
159, 160, 161----- Oakes	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
162, 163----- Ogarty	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
164*: Ogarty-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
165----- Ohop	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Moderate: droughty.
166----- Ohop	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Severe: small stones.
167, 168----- Olomount	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
169*: Olomount-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
170----- Oridia	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.
171*: Orthents-----	Severe: depth to rock, cutbanks cave, large stones.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, droughty, slope.
Humods-----	Severe: depth to rock, cutbanks cave, large stones.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, droughty, slope.
172, 173----- Ovall	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
174----- Pastik	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
175, 176----- Persis	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
177, 178----- Pheaney	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
179, 180----- Pheaney	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
181*: Pheeney-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
182, 183----- Philippa	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
184----- Pierking	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, frost action.	Severe: wetness, droughty.
185*: Pierking-----	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, frost action.	Severe: wetness, droughty.
Borohemists-----	Severe: excess humus, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
186*: Pierking-----	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, droughty.
Mowich-----	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, slope.	Moderate: low strength, wetness, slope.	Moderate: wetness, slope.
187----- Pilchuck	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: droughty.
188, 189, 190, 191, 192, 193---- Pitcher	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
194*: Pitcher-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
195*----- Pits	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight-----	Severe: small stones, droughty.
196, 197, 198---- Playco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
199, 200----- Playco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
201*: Playco-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
201*: Rock outcrop.						
202----- Puget	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding.	Moderate: wetness, flooding.
203----- Ragnar	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
204----- Ragnar	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
205*: Ragnar-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Lynnwood-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
206*: Ragnar-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lynnwood-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
207----- Reggad	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, excess humus.
208*: Reggad-----	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, excess humus.
Haywire-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
209*: Reggad-----	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, excess humus.
Klapatche-----	Severe: depth to rock, cutbanks cave, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Rock outcrop.						

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
210*: Reggad-----	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope, excess humus.
Serene-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
211, 212, 213, 214----- Reichel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
215*----- Riverwash	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: small stones, wetness, droughty.
216, 217----- Rober	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
218*. Rock outcrop.						
219*: Rock outcrop.						
Cattcreek-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
220*: Rock outcrop.						
Cayuse-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
221*: Rock outcrop.						
Haywire-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
222*: Rock outcrop.						
Rubble land-----	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, large stones, droughty.
Haywire-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
223*: Rock outcrop.						
Rubble land-----	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, large stones, droughty.
Serene-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
224*----- Rubble land	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, large stones, droughty.
225----- Rugles	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
226----- Salal	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
227----- Sauk	Slight-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
228----- Scamman	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
229, 230----- Scamman	Severe: wetness, slope.	Severe: wetness, shrink-swell, slope.	Severe: wetness, slope, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, slope.
231----- Seattle	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: ponding, excess humus.
232, 233----- Serene	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
234*: Serene-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Rock outcrop.						
235----- Shalcar	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: ponding, excess humus.
236----- Si	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: flooding.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
237, 238----- Skykomish	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
239----- Skykomish	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
240----- Skykomish	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.
241, 242----- Snoqualmie	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty.
243----- Spukwush	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
244, 245, 246---- Stahl	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
247----- Sulsavar	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
248----- Sultan	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: shrink-swell, low strength, wetness.	Slight.
249, 250----- Teneriffe	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
251, 252, 253---- Teneriffe	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
254----- Tokul	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: small stones, wetness.
255----- Tokul	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope.	Moderate: small stones, wetness, slope.
256, 257----- Tokul	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
258*, 259*: Tokul-----	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
258*, 259*: Pastik-----	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: slope.	Severe: slope.
260----- Treen	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope, frost action.	Severe: slope, depth to rock.
261----- Tukwila	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: ponding, excess humus.
262, 263----- Tusip	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
264----- Typic Haplorthods	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
265, 266----- Typic Udifluvents	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
267----- Udifluvents	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty.
268, 269----- Vailton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
270----- Voight	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
271, 272----- Voight	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
273, 274----- Welcome	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
275----- Wilkeson	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: small stones.
276, 277----- Wilkeson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: small stones.
278----- Winston	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
279, 280----- Winston	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
281----- Woodinville	Severe: excess humus, wetness.	Severe: subsides, flooding.	Severe: subsides, flooding, wetness.	Severe: subsides, flooding.	Severe: subsides.	Moderate: wetness.
282----- Zynbar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
283----- Zynbar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
284----- Zynbar	Moderate: wetness.	Slight-----	Moderate: wetness.	Moderate: slope.	Severe: low strength, frost action.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1----- Alderwood	Severe: cemented pan, wetness.	Severe: seepage, cemented pan, slope.	Severe: seepage, wetness.	Severe: cemented pan, seepage.	Poor: cemented pan, small stones.
2----- Alderwood	Severe: cemented pan, wetness, slope.	Severe: seepage, cemented pan, slope.	Severe: seepage, wetness, slope.	Severe: cemented pan, seepage, slope.	Poor: cemented pan, small stones, slope.
3----- Alkiridge	Severe: cemented pan, wetness, slope.	Severe: seepage, cemented pan, slope.	Severe: wetness, slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.
4, 5, 6----- Altapeak	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
7*: Altapeak-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Rock outcrop.					
8----- Andic Cryumbrepts	Severe: depth to rock, slope, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, small stones, slope.
9----- Arents	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
10----- Barneston	Severe: poor filter.	Severe: seepage, large stones.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
11, 12----- Barneston	Severe: poor filter, slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
13----- Barneston	Severe: poor filter.	Severe: seepage, large stones.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
14, 15, 16----- Barneston	Severe: poor filter, slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
17, 18, 19----- Beausite	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
20----- Belfast	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too sandy.
21, 22----- Bellicum	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: seepage, small stones, slope.
23, 24----- Blethen	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
25----- Borohemists	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.
26----- Bromo	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: hard to pack, slope.
27, 28----- Cattcreek	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
29, 30----- Cattcreek	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
31----- Cattcreek	Severe: wetness, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
32, 33----- Cayuse	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
34----- Chinkmin	Severe: cemented pan, wetness.	Severe: cemented pan, slope, wetness.	Severe: wetness.	Severe: cemented pan.	Poor: cemented pan, small stones.
35, 36----- Chinkmin	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: wetness, slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
37----- Chinkmin	Severe: cemented pan, wetness.	Severe: cemented pan, slope, wetness.	Severe: wetness.	Severe: cemented pan.	Poor: cemented pan, small stones.
38----- Chinkmin	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: wetness, slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.
39, 40----- Christoff	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
41----- Chuckanut	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: depth to rock, small stones, slope.
42, 43----- Chuckanut	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
44----- Cinebar	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: hard to pack.
45, 46----- Cinebar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: hard to pack, slope.
47, 48----- Cotteral	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: hard to pack, slope.
49----- Crinker	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
50----- Cryofluvents	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, depth to rock, seepage.	Severe: flooding, seepage.	Poor: too sandy, small stones.
51----- Cryohemists	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
52----- Dobbs	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.
53----- Edgewick	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, too sandy.	Severe: flooding.	Poor: too sandy.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
54, 55----- Elwell	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: wetness, slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.
56, 57, 58, 59----- Ethanla	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
60----- Ethanla	Severe: wetness, slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
61, 62----- Foss	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
63, 64, 65----- Gallup	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
66----- Getchell	Severe: cemented pan, wetness.	Severe: cemented pan, slope, wetness.	Severe: wetness.	Severe: cemented pan.	Poor: cemented pan, small stones.
67, 68----- Getchell	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: wetness, slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.
69----- Greenwater	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
70----- Grotto	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
71----- Hartnit	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
72, 73, 74, 75----- Haywire	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
76, 77, 78----- Hinker	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, large stones, slope.
79----- Humaquepts	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, small stones, wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
80, 81, 82----- Index	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
83*: Index-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Rock outcrop.					
84, 85----- Jonas	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: hard to pack, small stones, slope.
86, 87, 88----- Jonas	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: hard to pack, large stones, slope.
89, 90, 91----- Kaleetan	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
92, 93----- Kaleetan	Severe: wetness, slope.	Severe: seepage, slope, wetness.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
94, 95----- Kaleetan	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
96, 97, 98, 99----- Kanaskat	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
100----- Kapowsin	Severe: cemented pan, wetness.	Severe: cemented pan, slope, wetness.	Severe: wetness.	Severe: cemented pan, wetness.	Poor: cemented pan, small stones.
101, 102----- Kapowsin	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: wetness, slope.	Severe: cemented pan, wetness, slope.	Poor: cemented pan, small stones, slope.
103----- Kindy	Severe: cemented pan, wetness.	Severe: cemented pan, slope, wetness.	Severe: wetness.	Severe: cemented pan.	Poor: cemented pan, small stones.
104, 105----- Kindy	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: wetness, slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
106----- Klaber	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
107*: Klaber-----	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Cinebar-----	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Poor: hard to pack.
108, 109----- Klapatche	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.
110*: Klapatche-----	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.
Rock outcrop.					
111----- Klaus	Severe: cemented pan, poor filter.	Severe: seepage, cemented pan.	Severe: seepage, too sandy.	Severe: cemented pan, seepage.	Poor: cemented pan, seepage, too sandy.
112----- Klaus	Severe: cemented pan, poor filter.	Severe: seepage, cemented pan, slope.	Severe: seepage, too sandy.	Severe: cemented pan, seepage.	Poor: cemented pan, seepage, too sandy.
113----- Klaus	Severe: cemented pan, poor filter, slope.	Severe: seepage, cemented pan, slope.	Severe: seepage, slope, too sandy.	Severe: cemented pan, seepage, slope.	Poor: cemented pan, seepage, too sandy.
114----- Klaus	Severe: cemented pan, poor filter.	Severe: seepage, cemented pan.	Severe: seepage, too sandy.	Severe: cemented pan, seepage.	Poor: cemented pan, seepage, too sandy.
115----- Klaus	Severe: cemented pan, poor filter, slope.	Severe: seepage, cemented pan, slope.	Severe: seepage, slope, too sandy.	Severe: cemented pan, seepage, slope.	Poor: cemented pan, seepage, too sandy.
116, 117----- Larrupin	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: small stones, slope.
118----- Larrupin	Severe: slope.	Severe: seepage, slope.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
119----- Lemolo	Severe: wetness, percs slowly.	Moderate: seepage, slope, excess humus.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
120, 121, 122, 123, 124, 125----- Littlejohn	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
126*: Littlejohn-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
Rock outcrop.					
127----- Lynnwood	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
128, 129----- Marblemount	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, small stones, slope.
130----- Marblemount	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, small stones.
131*: Marblemount-----	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, small stones, slope.
Rock outcrop.					
132, 133----- Mashel	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
134, 135, 136, 137-- Melakwa	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, seepage, small stones.
138*: Melakwa-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, seepage, small stones.
Rock outcrop.					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
139----- Mowich	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
140----- Mukilteo	Severe: subsides, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.
141, 142, 143, 144-- Nagrom	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
145*: Nagrom-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
Rock outcrop.					
146----- Nargar	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
147----- Nargar	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
148*: Nargar-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Pastik-----	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Poor: slope.
149----- National	Severe: poor filter.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Poor: thin layer.
150----- Neilton	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
151, 152, 153, 154, 155----- Nimue	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: seepage, small stones, slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
156*: Nimue-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: seepage, small stones, slope.
Rock outcrop.					
157----- Nooksack	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Fair: wetness.
158----- Norma	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
159----- Oakes	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
160, 161----- Oakes	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
162, 163----- Ogarty	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, seepage, small stones.
164*: Ogarty-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, seepage, small stones.
Rock outcrop.					
165----- Ohop	Severe: wetness, percs slowly.	Severe: seepage.	Moderate: wetness.	Moderate: wetness.	Poor: small stones.
166----- Ohop	Severe: wetness, percs slowly.	Severe: seepage, slope.	Moderate: wetness.	Moderate: wetness.	Poor: small stones.
167, 168----- Olomount	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, seepage, small stones.
169*: Olomount-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, seepage, small stones.
Rock outcrop.					
170----- Oridia	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
171*: Orthents-----	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, small stones.
Humods-----	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, small stones.
172, 173----- Ovall	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
174----- Pastik	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Poor: slope.
175, 176----- Persis	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
177, 178----- Pheeney	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
179, 180----- Pheeney	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
181*: Pheeney-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
Rock outcrop.					
182, 183----- Philippa	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.
184----- Pierking	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
185*: Pierking-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
185*: Borohemists-----	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.
186*: Pierking-----	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: seepage, small stones, wetness.
Mowich-----	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
187----- Pilchuck	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, small stones.
188, 189, 190, 191, 192, 193----- Pitcher	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
194*: Pitcher-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
195*----- Pits	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Slight-----	Poor: seepage, too sandy, small stones.
196, 197, 198----- Playco	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
199, 200----- Playco	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
201*: Playco-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
202----- Puget	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
203----- Ragnar	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
204----- Ragnar	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
205*: Ragnar-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Lynnwood-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
206*: Ragnar-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Lynnwood-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
207----- Reggad	Severe: poor filter, slope, large stones.	Severe: seepage, slope, excess humus.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
208*: Reggad-----	Severe: poor filter, slope, large stones.	Severe: seepage, slope, excess humus.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Haywire-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
209*: Reggad-----	Severe: poor filter, slope, large stones.	Severe: seepage, slope, excess humus.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Klapatche-----	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.
Rock outcrop.					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
210*: Reggad-----	Severe: poor filter, slope, large stones.	Severe: seepage, slope, excess humus.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Serene-----	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.
211, 212, 213, 214-- Reichel	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: hard to pack, slope.
215*----- Riverwash	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: too sandy, small stones, wetness.
216, 217----- Rober	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
218*. Rock outcrop					
219*: Rock outcrop.					
Cattcreek-----	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
220*: Rock outcrop.					
Cayuse-----	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
221*: Rock outcrop.					
Haywire-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
222*: Rock outcrop.					
Rubble land-----	Severe: poor filter, large stones.	Severe: seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: seepage, small stones, slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
222*: Haywire-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
223*: Rock outcrop.					
Rubble land-----	Severe: poor filter, large stones.	Severe: seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: seepage, small stones, slope.
Serene-----	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.
224*----- Rubble land	Severe: poor filter, large stones.	Severe: seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: seepage, small stones, slope.
225----- Rugles	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
226----- Salal	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
227----- Sauk	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: seepage.	Slight-----	Good.
228----- Scamman	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
229, 230----- Scamman	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: wetness, slope, too clayey.	Severe: wetness, slope.	Poor: too clayey, hard to pack, slope.
231----- Seattle	Severe: subsides, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.
232, 233----- Serene	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.
234*: Serene-----	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, seepage, too sandy.
Rock outcrop.					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
235----- Shalcar	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.
236----- Si	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
237, 238----- Skykomish	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
239----- Skykomish	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
240----- Skykomish	Severe: poor filter, slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
241, 242----- Snoqualmie	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, small stones.
243----- Spukwush	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
244, 245, 246----- Stahl	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
247----- Sulsavar	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
248----- Sultan	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness, thin layer.
249, 250----- Teneriffe	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
251, 252, 253----- Teneriffe	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
254----- Tokul	Severe: cemented pan, wetness.	Severe: cemented pan, wetness.	Severe: wetness.	Severe: cemented pan.	Poor: cemented pan, small stones.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
255----- Tokul	Severe: cemented pan, wetness.	Severe: cemented pan, slope, wetness.	Severe: wetness.	Severe: cemented pan.	Poor: cemented pan, small stones.
256, 257----- Tokul	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: wetness, slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.
258*, 259*: Tokul-----	Severe: cemented pan, wetness, slope.	Severe: cemented pan, slope, wetness.	Severe: wetness, slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.
Pastik-----	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Poor: slope.
260----- Treen	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
261----- Tukwila	Severe: subsides, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.
262, 263----- Tusip	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
264----- Typic Haplorthods	Severe: cemented pan, slope.	Severe: cemented pan, slope.	Severe: slope.	Severe: cemented pan, slope.	Poor: cemented pan, small stones, slope.
265, 266----- Typic Udifluvents	Severe: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: too sandy.
267----- Udifluvents	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.
268, 269----- Vailton	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: hard to pack, slope.
270----- Voight	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: hard to pack.
271, 272----- Voight	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: hard to pack, slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
273, 274----- Welcome	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
275----- Wilkeson	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
276, 277----- Wilkeson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
278----- Winston	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
279, 280----- Winston	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
281----- Woodinville	Severe: wetness, percs slowly.	Severe: excess humus, wetness.	Severe: wetness.	Severe: wetness.	Poor: thin layer.
282----- Zynbar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: hard to pack, slope.
283----- Zynbar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: hard to pack, slope.
284----- Zynbar	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Slight-----	Poor: hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1----- Alderwood	Fair: thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
2----- Alderwood	Fair: thin layer, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
3----- Alkiridge	Fair: thin layer, wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
4----- Altapeak	Fair: depth to rock, thin layer, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones, area reclaim.
5, 6----- Altapeak	Poor: slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones, area reclaim.
7*: Altapeak-----	Poor: slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones, area reclaim.
Rock outcrop.				
8----- Andic Cryumbrepts	Poor: depth to rock, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
9----- Arents	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
10----- Barneston	Fair: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
11----- Barneston	Fair: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
12----- Barneston	Poor: slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
13----- Barneston	Fair: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
14----- Barneston	Fair: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
15----- Barneston	Poor: slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
16----- Barneston	Fair: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
17----- Beausite	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
18, 19----- Beausite	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
20----- Belfast	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
21----- Bellicum	Fair: depth to rock, thin layer, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
22----- Bellicum	Poor: slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
23----- Blethen	Fair: large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
24----- Blethen	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
25----- Borohemists	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
26----- Bromo	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, slope.
27, 28----- Cattcreek	Poor: slope.	Improbable: small stones.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
29, 30----- Cattcreek	Poor: slope.	Improbable: small stones.	Probable-----	Poor: too sandy, small stones, area reclaim.
31----- Cattcreek	Fair: thin layer, slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
32----- Cayuse	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
33----- Cayuse	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
34----- Chinkmin	Fair: thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
35----- Chinkmin	Fair: thin layer, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
36----- Chinkmin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
37----- Chinkmin	Fair: thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
38----- Chinkmin	Fair: thin layer, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
39----- Christoff	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
40----- Christoff	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
41----- Chuckanut	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
42----- Chuckanut	Fair: depth to rock, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
43----- Chuckanut	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
44----- Cinebar	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
45----- Cinebar	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
46----- Cinebar	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
47----- Cotteral	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, slope.
48----- Cotteral	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, slope.
49----- Crinker	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
50----- Cryofluvents	Fair: depth to rock, thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, area reclaim.
51----- Cryohemists	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
52----- Dobbs	Fair: thin layer, wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
53----- Edgewick	Good-----	Probable-----	Probable-----	Poor: too sandy, area reclaim.
54----- Elwell	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
55----- Elwell	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
56, 57, 58, 59----- Ethanias	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
60----- Ethanias	Fair: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
61----- Foss	Fair: large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
62----- Foss	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
63----- Gallup	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
64, 65----- Gallup	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
66----- Getchell	Fair: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
67----- Getchell	Fair: thin layer, wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
68----- Getchell	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
69----- Greenwater	Good-----	Probable-----	Probable-----	Poor: too sandy, area reclaim.
70----- Grotto	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
71----- Hartnit	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
72----- Haywire	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
73----- Haywire	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
74----- Haywire	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
75----- Haywire	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
76----- Hinker	Poor: depth to rock.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
77, 78----- Hinker	Poor: depth to rock, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
79----- Humaquepts	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, area reclaim.
80----- Index	Fair: depth to rock, thin layer, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
81, 82----- Index	Poor: slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
83*: Index-----	Poor: slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
Rock outcrop.				
84----- Jonas	Fair: depth to rock, shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
85----- Jonas	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
86----- Jonas	Fair: low strength, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
87, 88----- Jonas	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
89----- Kaleetan	Fair: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
90, 91----- Kaleetan	Poor: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
92----- Kaleetan	Fair: thin layer, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
93----- Kaleetan	Poor: slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
94----- Kaleetan	Fair: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
95----- Kaleetan	Poor: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
96----- Kanaskat	Fair: slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
97----- Kanaskat	Poor: slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
98----- Kanaskat	Fair: slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
99----- Kanaskat	Poor: slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
100----- Kapowsin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
101----- Kapowsin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
102----- Kapowsin	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
103----- Kindy	Fair: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
104----- Kindy	Fair: thin layer, wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
105----- Kindy	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
106----- Klaber	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
107*: Klaber-----	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Cinebar-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
108----- Klapatche	Poor: depth to rock.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones, slope.
109----- Klapatche	Poor: depth to rock, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones, slope.
110*: Klapatche-----	Poor: depth to rock, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones, slope.
Rock outcrop.				
111, 112----- Klaus	Poor: thin layer.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
113----- Klaus	Poor: thin layer, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
114----- Klaus	Poor: thin layer.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones.
115----- Klaus	Poor: thin layer, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
116----- Larrupin	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
117----- Larrupin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
118----- Larrupin	Fair: thin layer, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, small stones, slope.
119----- Lemolo	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, wetness.
120----- Littlejohn	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
121, 122----- Littlejohn	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
123----- Littlejohn	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
124, 125----- Littlejohn	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
126*: Littlejohn-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Rock outcrop.				
127----- Lynnwood	Good-----	Probable-----	Improbable: too sandy.	Fair: too sandy, small stones, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
128----- Marblemount	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
129----- Marblemount	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
130----- Marblemount	Poor: depth to rock, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
131*: Marblemount-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Rock outcrop.				
132----- Mashel	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
133----- Mashel	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
134----- Melakwa	Poor: depth to rock.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
135, 136, 137----- Melakwa	Poor: depth to rock, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
138*: Melakwa-----	Poor: depth to rock, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, slope.
Rock outcrop.				
139----- Mowich	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, thin layer.
140----- Mukilteo	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
141----- Nagrom	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
142----- Nagrom	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
143----- Nagrom	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
144----- Nagrom	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
145*: Nagrom----- Rock outcrop.	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
146----- Nargar	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
147----- Nargar	Fair: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
148*: Nargar-----	Poor: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
Pastik-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
149----- National	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones.
150----- Neilton	Fair: large stones.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
151----- Nimue	Fair: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
152, 153----- Nimue	Poor: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
154----- Nimue	Fair: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
155----- Nimue	Poor: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
156*: Nimue-----	Poor: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
Rock outcrop.				
157----- Nooksack	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
158----- Norma	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, wetness.
159----- Oakes	Fair: large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
160----- Oakes	Fair: thin layer, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
161----- Oakes	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
162----- Ogarty	Poor: depth to rock.	Improbable: small stones.	Probable-----	Poor: small stones, slope.
163----- Ogarty	Poor: depth to rock, slope.	Improbable: small stones.	Probable-----	Poor: small stones, slope.
164*: Ogarty-----	Poor: depth to rock, slope.	Improbable: small stones.	Probable-----	Poor: small stones, slope.
Rock outcrop.				
165, 166----- Ohop	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
167----- Olomount	Poor: depth to rock.	Improbable: small stones.	Improbable: thin layer.	Poor: small stones, slope.
168----- Olomount	Poor: depth to rock, slope.	Improbable: small stones.	Improbable: thin layer.	Poor: small stones, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
169*: Olomount-----	Poor: depth to rock, slope.	Improbable: small stones.	Improbable: thin layer.	Poor: small stones, slope.
Rock outcrop.				
170----- Oridia	Fair: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
171*: Orthents-----	Poor: depth to rock, large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: small stones, slope.
Humods-----	Poor: depth to rock, large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: small stones, slope.
172----- Ovall	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
173----- Ovall	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
174----- Pastik	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
175, 176----- Persis	Good-----	Probable-----	Improbable: too sandy.	Poor: small stones.
177----- Pheeney	Poor: depth to rock.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
178----- Pheeney	Poor: depth to rock, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
179----- Pheeney	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
180----- Pheeney	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
181*: Pheeney-----	Poor: depth to rock, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, slope.
Rock outcrop.				

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
182----- Philippa	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
183----- Philippa	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
184----- Pierking	Poor: wetness.	Probable-----	Probable-----	Poor: small stones, area reclaim, wetness.
185*: Pierking-----	Poor: wetness.	Probable-----	Probable-----	Poor: small stones, area reclaim, wetness.
Borohemists-----	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
186*: Pierking-----	Poor: wetness.	Probable-----	Probable-----	Poor: small stones, area reclaim, wetness.
Mowich-----	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, thin layer.
187----- Pilchuck	Fair: wetness.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim.
188----- Pitcher	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
189, 190----- Pitcher	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
191----- Pitcher	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
192, 193----- Pitcher	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
194*: Pitcher-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
195*----- Pits	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
196----- Playco	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
197, 198----- Playco	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
199----- Playco	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
200----- Playco	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
201*: Playco-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
202----- Puget	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
203----- Ragnar	Good-----	Probable-----	Improbable: too sandy.	Fair: small stones, thin layer, slope.
204----- Ragnar	Fair: slope.	Probable-----	Improbable: too sandy.	Poor: slope.
205*: Ragnar-----	Good-----	Probable-----	Improbable: too sandy.	Fair: small stones, thin layer, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
205*: Lynnwood-----	Good-----	Probable-----	Improbable: too sandy.	Fair: too sandy, small stones, slope.
206*: Ragnar-----	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: slope.
Lynnwood-----	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: slope.
207----- Reggad	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
208*: Reggad-----	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
Haywire-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
209*: Reggad-----	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
Klapatche-----	Poor: depth to rock, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: too sandy, small stones, slope.
Rock outcrop.				
210*: Reggad-----	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
Serene-----	Poor: depth to rock, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, slope.
211----- Reichel	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
212----- Reichel	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
213----- Reichel	Fair: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
214----- Reichel	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
215*----- Riverwash	Poor: wetness.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
216----- Rober	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
217----- Rober	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
218*. Rock outcrop				
219*: Rock outcrop.				
Cattcreek-----	Poor: slope.	Improbable: small stones.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
220*: Rock outcrop.				
Cayuse-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
221*: Rock outcrop.				
Haywire-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
222*: Rock outcrop.				
Rubble land-----	Poor: large stones, slope.	Improbable: small stones, large stones.	Improbable: large stones.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
222*: Haywire-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
223*: Rock outcrop.				
Rubble land-----	Poor: large stones, slope.	Improbable: small stones, large stones.	Improbable: large stones.	Poor: small stones, area reclaim, slope.
Serene-----	Poor: depth to rock, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, slope.
224*----- Rubble land	Poor: large stones, slope.	Improbable: small stones, large stones.	Improbable: large stones.	Poor: small stones, area reclaim, slope.
225----- Rugles	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
226----- Salal	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
227----- Sauk	Good-----	Probable-----	Probable-----	Fair: small stones.
228, 229, 230----- Scamman	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, wetness.
231----- Seattle	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
232----- Serene	Poor: depth to rock.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, slope.
233----- Serene	Poor: depth to rock, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, slope.
234*: Serene-----	Poor: depth to rock, slope.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, slope.
Rock outcrop.				

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
235----- Shalcar	Poor: wetness.	Probable-----	Probable-----	Poor: excess humus, wetness.
236----- Si	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
237----- Skykomish	Fair: slope.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
238----- Skykomish	Poor: slope.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
239----- Skykomish	Fair: slope.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
240----- Skykomish	Fair: large stones, slope.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
241, 242----- Snoqualmie	Fair: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
243----- Spukwush	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
244----- Stahl	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
245----- Stahl	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
246----- Stahl	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
247----- Sulsavar	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
248----- Sultan	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
249----- Teneriffe	Fair: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
250----- Teneriffe	Poor: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
251, 252----- Teneriffe	Fair: depth to rock, thin layer, slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
253----- Teneriffe	Poor: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.
254, 255----- Tokul	Fair: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
256----- Tokul	Fair: thin layer, wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
257----- Tokul	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
258*, 259*: Tokul-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Pastik-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
260----- Treen	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
261----- Tukwila	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
262----- Tusip	Fair: depth to rock, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
263----- Tusip	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
264----- Typic Haplorthods	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
265, 266----- Typic Udifluvents	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
267----- Udifluvents	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
268----- Vailton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
269----- Vailton	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
270----- Voight	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
271----- Voight	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
272----- Voight	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
273----- Welcome	Fair: depth to rock, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
274----- Welcome	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
275----- Wilkeson	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
276----- Wilkeson	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
277----- Wilkeson	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
278----- Winston	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
279, 280----- Winston	Fair: slope.	Probable-----	Probable-----	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
281----- Woodinville	Fair: low strength, thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
282----- Zynbar	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
283----- Zynbar	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
284----- Zynbar	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1, 2----- Alderwood	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Cemented pan, large stones, slope.	Slope, large stones, wetness.	Slope, large stones, cemented pan.	Large stones, slope, droughty.
3----- Alkiridge	Severe: slope.	Moderate: thin layer, seepage, wetness.	Severe: no water.	Cemented pan, slope.	Slope, wetness, soil blowing.	Slope, cemented pan, wetness.	Slope, cemented pan.
4, 5, 6----- Altapeak	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
7*: Altapeak-----	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Rock outcrop.							
8----- Andic Cryumbrepts	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
9----- Arents	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Large stones, too sandy.	Large stones, droughty.
10----- Barneston	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Large stones, too sandy.	Large stones, droughty.
11, 12----- Barneston	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
13----- Barneston	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Large stones, too sandy.	Large stones, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
14, 15, 16----- Barneston	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
17, 18, 19----- Beausite	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, depth to rock.	Slope, depth to rock.	Slope, droughty, depth to rock.
20----- Belfast	Moderate: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Flooding-----	Erodes easily, too sandy.	Erodes easily.
21, 22----- Bellicum	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
23, 24----- Blethen	Severe: slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.
25----- Borochemists	Moderate: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, subsides, frost action.	Ponding-----	Ponding-----	Wetness.
26----- Bromo	Severe: seepage, slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
27, 28----- Cattcreek	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope-----	Slope, droughty.
29, 30----- Cattcreek	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing.	Slope, droughty.
31----- Cattcreek	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
32, 33----- Cayuse	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
34----- Chinkmin	Moderate: seepage, cemented pan, slope.	Severe: seepage.	Severe: no water.	Cemented pan, large stones, slope.	Slope, large stones, wetness.	Large stones, cemented pan.	Large stones, droughty.
35, 36----- Chinkmin	Severe: slope.	Severe: seepage.	Severe: no water.	Cemented pan, large stones, slope.	Slope, large stones, wetness.	Slope, large stones, cemented pan.	Large stones, slope, droughty.
37----- Chinkmin	Moderate: seepage, cemented pan, slope.	Severe: seepage.	Severe: no water.	Cemented pan, large stones, slope.	Slope, large stones, wetness.	Large stones, cemented pan.	Large stones, droughty.
38----- Chinkmin	Severe: slope.	Severe: seepage.	Severe: no water.	Cemented pan, large stones, slope.	Slope, large stones, wetness.	Slope, large stones, cemented pan.	Large stones, slope, droughty.
39, 40----- Christoff	Severe: slope.	Moderate: wetness.	Severe: no water.	Frost action, slope.	Slope, wetness, soil blowing.	Slope, erodes easily, wetness.	Slope, erodes easily.
41, 42, 43----- Chuckanut	Severe: slope.	Moderate: thin layer, seepage.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
44, 45, 46----- Cinebar	Severe: slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
47, 48----- Cotteral	Severe: seepage, slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Droughty, slope.	Slope-----	Slope, droughty.
49----- Crinker	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
50----- Cryofluvents	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Large stones, too sandy.	Large stones, droughty.
51----- Cryohemists	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding-----	Ponding-----	Wetness.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
52----- Dobbs	Severe: slope.	Severe: seepage.	Severe: no water.	Cemented pan, slope.	Slope, wetness, cemented pan.	Slope, large stones, cemented pan.	Large stones, slope, cemented pan.
53----- Edgewick	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, flooding.	Erodes easily, too sandy.	Erodes easily, droughty.
54, 55----- Elwell	Severe: slope.	Severe: piping.	Severe: no water.	Cemented pan, frost action, slope.	Slope, wetness, cemented pan.	Slope, cemented pan, wetness.	Slope, cemented pan.
56, 57, 58, 59---- Ethanias	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, too sandy.	Large stones, slope, droughty.
60----- Ethanias	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
61, 62----- Foss	Severe: slope.	Moderate: seepage, piping, large stones.	Severe: no water.	Deep to water	Large stones, slope.	Slope, large stones.	Large stones, slope.
63, 64, 65----- Gallup	Severe: slope.	Moderate: seepage, piping.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
66, 67, 68----- Getchell	Severe: slope.	Severe: piping.	Severe: no water.	Cemented pan, frost action, slope.	Slope, wetness, cemented pan.	Slope, cemented pan, wetness.	Slope, cemented pan.
69----- Greenwater	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
70----- Grotto	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
71----- Hartnit	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
72, 73, 74, 75---- Haywire	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
76, 77, 78----- Hinker	Severe: slope.	Moderate: seepage, piping, large stones.	Severe: no water.	Deep to water	Slope, large stones, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
79----- Humaquepts	Moderate: seepage.	Severe: seepage, piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action, cutbanks cave.	Wetness, droughty.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, droughty.
80, 81, 82----- Index	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
83*: Index----- Rock outcrop.	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
84, 85----- Jonas	Severe: slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Slope, large stones.	Large stones, slope.
86, 87, 88----- Jonas	Severe: slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.
89, 90, 91----- Kaleetan	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
92, 93----- Kaleetan	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, large stones, too sandy.	Large stones, slope, droughty.
94, 95----- Kaleetan	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
96, 97, 98, 99---- Kanaskat	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
100, 101, 102----- Kapowsin	Severe: slope.	Severe: thin layer.	Severe: no water.	Cemented pan, slope.	Slope, wetness, cemented pan.	Slope, cemented pan, wetness.	Wetness, slope, cemented pan.
103----- Kindy	Moderate: seepage, cemented pan, slope.	Severe: seepage.	Severe: no water.	Cemented pan, slope.	Slope, wetness, cemented pan.	Large stones, cemented pan.	Large stones, cemented pan.
104, 105----- Kindy	Severe: slope.	Severe: seepage.	Severe: no water.	Cemented pan, slope.	Slope, wetness, cemented pan.	Slope, large stones, cemented pan.	Large stones, slope, cemented pan.
106----- Klaber	Moderate: slope.	Severe: ponding.	Severe: no water.	Ponding, percs slowly, slope.	Ponding, percs slowly, slope.	Ponding, percs slowly.	Wetness, percs slowly.
107*: Klaber-----	Moderate: slope.	Severe: ponding.	Severe: no water.	Ponding, percs slowly, slope.	Ponding, percs slowly, slope.	Ponding, percs slowly.	Wetness, percs slowly.
Cinebar-----	Moderate: seepage, slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.
108, 109----- Klapatche	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
110*: Klapatche-----	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.							
111----- Klaus	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Large stones, cemented pan.	Large stones, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
112, 113----- Klaus	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, cemented pan.	Large stones, slope, droughty.
114----- Klaus	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Large stones, cemented pan.	Large stones, droughty.
115----- Klaus	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, cemented pan.	Large stones, slope, droughty.
116, 117----- Larrupin	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
118----- Larrupin	Severe: slope.	Severe: piping, large stones.	Severe: no water.	Deep to water	Slope, large stones, fast intake.	Slope, large stones, soil blowing.	Large stones, slope.
119----- Lemolo	Moderate: slope.	Severe: wetness.	Severe: no water.	Percs slowly, slope.	Wetness, percs slowly, slope.	Large stones, erodes easily, wetness.	Large stones, wetness, erodes easily.
120, 121, 122, 123, 124, 125---- Littlejohn	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
126*: Littlejohn-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Rock outcrop.							
127----- Lynnwood	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
128, 129----- Marblemount	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
130----- Marblemount	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, depth to rock, too sandy.	Slope, droughty, depth to rock.
131*: Marblemount----- Rock outcrop.	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
132, 133----- Mashel	Severe: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
134, 135, 136, 137----- Melakwa	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, soil blowing.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
138*: Melakwa----- Rock outcrop.	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, soil blowing.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
139----- Mowich	Moderate: seepage, slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, slope.	Wetness, percs slowly, slope.	Wetness, percs slowly.	Wetness, percs slowly.
140----- Mukilteo	Moderate: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, subsides.	Ponding-----	Ponding-----	Wetness.
141, 142----- Nagrom	Severe: slope.	Moderate: thin layer, seepage.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
143, 144----- Nagrom	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
145*: Nagrom-----	Severe: slope.	Moderate: thin layer, seepage.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, depth to rock, soil blowing.	Slope, depth to rock.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
145*: Rock outcrop.							
146----- Nargar	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, soil blowing.	Too sandy, soil blowing.	Favorable.
147----- Nargar	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, too sandy, soil blowing.	Slope.
148*: Nargar-----	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, too sandy, soil blowing.	Slope.
Pastik-----	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.
149----- National	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.
150----- Neilton	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
151, 152, 153, 154, 155----- Nimue	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
156*: Nimue-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
Rock outcrop.							
157----- Nooksack	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
158----- Norma	Severe: seepage.	Severe: ponding.	Moderate: slow refill.	Ponding-----	Ponding-----	Erodes easily, ponding.	Wetness, erodes easily.
159, 160, 161----- Oakes	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
162, 163----- Ogarty	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
164*: Ogarty-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.							
165, 166----- Ohop	Moderate: seepage, slope.	Severe: seepage.	Severe: no water.	Percs slowly, large stones, slope.	Slope, wetness, droughty.	Large stones, wetness.	Large stones, droughty.
167, 168----- Olomount	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
169*: Olomount-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Rock outcrop.							
170----- Oridia	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding-----	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
171*: Orthents-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Humods-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
172, 173----- Ovall	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
174----- Pastik	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
175, 176----- Persis	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Too sandy, soil blowing.	Favorable.
177, 178----- Pheeney	Severe: slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
179, 180----- Pheeney	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
181*: Pheeney-----	Severe: slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Rock outcrop.							
182, 183----- Philippa	Severe: slope.	Severe: seepage.	Severe: no water.	Cemented pan, large stones, slope.	Slope, wetness, soil blowing.	Slope, cemented pan, wetness.	Slope, cemented pan.
184----- Pierking	Slight-----	Severe: seepage, wetness.	Severe: slow refill, cutbanks cave.	Frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty, rooting depth.
185*: Pierking-----	Slight-----	Severe: seepage, wetness.	Severe: slow refill, cutbanks cave.	Frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty, rooting depth.
Borohemists-----	Moderate: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, subsides, frost action.	Ponding-----	Ponding-----	Wetness.
186*: Pierking-----	Moderate: slope.	Severe: seepage, wetness.	Severe: slow refill, cutbanks cave.	Frost action, slope, cutbanks cave.	Slope, wetness, droughty.	Wetness, too sandy.	Wetness, droughty, rooting depth.
Mowich-----	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, slope.	Wetness, percs slowly, slope.	Slope, wetness, percs slowly.	Wetness, slope, percs slowly.
187----- Pilchuck	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
188, 189, 190, 191, 192, 193---- Pitcher	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
194*: Pitcher-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
Rock outcrop.							
195*----- Pits	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake.	Large stones, too sandy.	Large stones, droughty.
196, 197, 198---- Playco	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope.
199, 200----- Playco	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing.	Slope, droughty.
201*: Playco-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope.
Rock outcrop.							
202----- Puget	Slight-----	Severe: piping, wetness.	Severe: slow refill.	Flooding-----	Wetness, percs slowly, flooding.	Wetness-----	Wetness.
203, 204----- Ragnar	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope-----	Slope, too sandy.	Slope.
205*, 206*: Ragnar-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope-----	Slope, too sandy.	Slope.
Lynnwood-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
207----- Reggad	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.
208*: Reggad-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.
Haywire-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
209*: Reggad-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.
Klapatche-----	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.							
210*: Reggad-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.
Serene-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
211, 212, 213, 214----- Reichel	Severe: slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
215*----- Riverwash	Severe: seepage.	Severe: wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Large stones, wetness, too sandy.	Large stones, wetness, droughty.
216, 217----- Rober	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
218*. Rock outcrop							
219*: Rock outcrop.							
Cattcreek-----	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope-----	Slope, droughty.
220*: Rock outcrop.							
Cayuse-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, soil blowing.	Slope, droughty.
221*: Rock outcrop.							
Haywire-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
222*: Rock outcrop.							
Rubble land-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Haywire-----	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
223*: Rock outcrop.							
Rubble land-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Serene-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
224*----- Rubble land	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
225----- Rugles	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.
226----- Salal	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
227----- Sauk	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.
228, 229, 230----- Scamman	Severe: slope.	Severe: wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, wetness, percs slowly.	Wetness, slope, percs slowly.
231----- Seattle	Moderate: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, subsides.	Ponding-----	Ponding-----	Wetness.
232, 233----- Serene	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
234*: Serene-----	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.							
235----- Shalcar	Severe: seepage.	Severe: excess humus, ponding.	Severe: cutbanks cave.	Ponding, subsides.	Ponding-----	Erodes easily, ponding.	Wetness, erodes easily.
236----- Si	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Flooding-----	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Erodes easily.
237, 238----- Skykomish	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
239----- Skykomish	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
240----- Skykomish	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
241, 242----- Snoqualmie	Severe: seepage.	Severe: seepage, large stones.	Severe: cutbanks cave.	Deep to water	Slope, large stones, droughty.	Large stones, too sandy.	Large stones, droughty.
243----- Spukwush	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, fast intake, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
244, 245, 246----- Stahl	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
247----- Sulsavar	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.
248----- Sultan	Moderate: seepage.	Severe: piping.	Severe: slow refill, cutbanks cave.	Favorable-----	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
249, 250----- Teneriffe	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
251, 252, 253----- Teneriffe	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, slope.	Slope, large stones, too sandy.	Large stones, slope, droughty.
254----- Tokul	Moderate: seepage, cemented pan, slope.	Severe: thin layer.	Severe: no water.	Cemented pan, slope.	Slope, wetness, cemented pan.	Cemented pan, wetness.	Cemented pan.
255, 256, 257----- Tokul	Severe: slope.	Severe: thin layer.	Severe: no water.	Cemented pan, slope.	Slope, wetness, cemented pan.	Slope, cemented pan, wetness.	Slope, cemented pan.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
258*, 259*: Tokul-----	Severe: slope.	Severe: thin layer.	Severe: no water.	Cemented pan, slope.	Slope, wetness, cemented pan.	Slope, cemented pan, wetness.	Slope, cemented pan.
Pastik-----	Severe: slope.	Severe: piping.	Severe: no water.	Perchs slowly, slope.	Slope, wetness, perchs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, perchs slowly.
260----- Treen	Severe: depth to rock, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
261----- Tukwila	Moderate: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, subsides.	Ponding-----	Ponding-----	Wetness.
262, 263----- Tusip	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
264----- Typic Haplorthods	Severe: slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, cemented pan.	Slope, cemented pan.	Slope, droughty, cemented pan.
265, 266----- Typic Udifluvents	Moderate: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, erodes easily, flooding.	Erodes easily, too sandy.	Erodes easily, droughty.
267----- Udifluvents	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, slope, flooding.	Large stones---	Large stones, droughty.
268, 269----- Vailton	Severe: slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
270, 271, 272----- Voight	Severe: slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
273, 274----- Welcome	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.
275, 276, 277----- Wilkeson	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
278----- Winston	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope-----	Too sandy-----	Favorable.
279, 280----- Winston	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope-----	Slope, too sandy.	Slope.
281----- Woodinville	Slight-----	Severe: piping, wetness.	Severe: slow refill.	Subsides-----	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
282----- Zynbar	Severe: slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
283----- Zynbar	Severe: slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Slope-----	Slope.
284----- Zynbar	Moderate: seepage, slope.	Severe: piping, hard to pack.	Severe: no water.	Deep to water	Slope-----	Favorable-----	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

[illegible]

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct						
7*: Altapeak-----	0-6	Gravelly sandy loam.	GM, SM	A-1, A-2	0	0-5	60-85	50-75	35-60	20-35	15-20	NP-5
	6-16	Very gravelly sandy loam, very gravelly loam, gravelly sandy loam.	GM, GM-GC, SM, SC-SM	A-1, A-2	0	0-10	45-75	35-65	25-50	15-35	15-30	NP-10
	16-24	Very gravelly sandy loam, very cobbly loamy sand, very cobbly sandy loam.	GM, SM	A-1	0	5-30	40-60	30-50	20-35	10-20	15-20	NP-5
	24-50	Extremely cobbly loamy sand, extremely gravelly coarse sand, very gravelly loamy coarse sand.	GP, GP-GM, SP, SP-SM	A-1	0	10-40	35-65	25-55	15-25	0-10	---	NP
	50	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
8----- Andic Cryumbrepts	0-5	Very gravelly sandy loam.	GM, SM	A-1, A-2	---	10-25	40-70	30-60	20-45	15-30	15-25	NP-5
	5-16	Very cobbly sandy loam, very gravelly sandy loam.	SM	A-1, A-2, A-4	---	15-40	60-80	45-55	35-50	20-40	15-25	NP-5
	16-44	Extremely stony sandy loam, extremely cobbly loam, extremely gravelly sandy loam.	GM	A-1, A-2	---	30-65	50-65	15-35	10-30	10-30	15-25	NP-5
	44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
9----- Arents	0-35	Gravelly sandy loam.	GM, SM	A-2	0	0	60-80	50-75	40-60	25-35	15-25	NP-5
	35-60	Stratified extremely gravelly coarse sand to gravelly sandy loam.	GP, SP, GP-GM, SP-SM	A-1	---	5-25	45-60	25-55	20-35	0-15	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct						
10, 11, 12---- Barneston	0-9	Gravelly coarse sandy loam.	SM	A-1, A-2	---	0-15	75-85	60-75	40-55	20-30	25-35	NP-5
	9-14	Very gravelly loam, very gravelly sandy loam, extremely cobbly sandy loam.	GM, GP-GM	A-1, A-2	---	5-60	25-60	20-50	10-40	5-30	20-30	NP-5
	14-60	Very gravelly sand, extremely gravelly loamy sand, extremely gravelly sand.	GP, GP-GM	A-1	---	0-25	30-40	20-35	5-25	0-10	---	NP
13, 14, 15, 16----- Barneston	0-9	Gravelly sandy loam.	SM	A-1, A-2	---	0-15	75-85	60-75	40-55	20-30	25-35	NP-5
	9-17	Very gravelly loam, very gravelly sandy loam, extremely cobbly sandy loam.	GM, GP-GM	A-1, A-2	---	5-60	25-60	20-50	10-40	5-30	20-30	NP-5
	17-60	Very gravelly sand, extremely gravelly loamy sand, extremely gravelly sand.	GP, GP-GM	A-1	---	0-25	30-40	20-35	5-25	0-10	---	NP
17, 18, 19---- Beausite	0-5	Gravelly loam	GM-GC	A-4	0	0	60-70	50-70	40-60	35-50	20-30	5-10
	5-11	Very gravelly sandy loam, very gravelly loam.	SM	A-1, A-2	0	0	60-70	40-50	30-40	15-30	15-25	NP-5
	11-36	Very gravelly sandy loam, extremely gravelly sandy loam.	SM, GM, GP-GM, SP-SM	A-1	---	0-15	45-65	15-50	10-30	5-20	15-25	NP-5
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
20----- Belfast	0-7	Silt loam-----	ML	A-4	0	0	100	100	80-90	70-80	30-40	NP-5
	7-38	Silt loam, loam, fine sandy loam.	ML	A-4	0	0	100	100	75-85	55-75	30-40	NP-5
	38-60	Stratified silt loam to loamy sand.	ML	A-4	---	0-5	90-100	85-100	70-80	50-60	25-35	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
21, 22----- Bellicum	0-6	Very cindery loamy sand.	SM, SP-SM	A-1	0	0	75-100	25-50	15-40	5-15	---	NP
	6-21	Very gravelly sand, very cindery loamy sand, extremely cindery loamy sand.	SP, SP-SM	A-1	0	0	75-100	20-50	10-30	0-15	---	NP
	21-39	Very gravelly fine sandy loam, very cobbly sandy loam.	SM	A-1, A-2	---	25-40	60-75	40-65	25-50	10-30	25-45	NP-10
	39-52	Extremely cobbly sandy loam.	GM, GP-GM	A-1, A-2	---	50-65	35-50	10-45	5-30	5-20	25-45	NP-10
	52	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
23, 24----- Blethen	0-5	Gravelly loam	GM, SM	A-4, A-2	---	0-10	65-80	55-70	40-65	30-50	30-40	NP-5
	5-24	Very gravelly sandy loam, very cobbly loam, very gravelly loam.	GM, SM	A-1, A-2, A-4	---	10-40	55-80	45-65	35-55	20-50	20-30	NP-5
	24-42	Very cobbly silt loam, very gravelly loam, extremely gravelly sandy loam.	GM	A-1, A-2	---	10-40	40-60	25-50	20-35	10-35	20-30	NP-5
	42-60	Very cobbly loam, extremely gravelly sandy loam, extremely gravelly loamy sand.	GM	A-1, A-2	---	10-40	30-60	20-50	15-45	10-35	15-25	NP-5
25----- Borochemists	0-4	Mucky-peat----	PT	A-8	0	0	---	---	---	---	---	---
	4-30	Hemic material	PT	A-8	0	0	---	---	---	---	---	---
	30-60	Variable-----	---	---	---	---	---	---	---	---	---	---
26----- Bromo	0-4	Very cindery sandy loam.	SM	A-2, A-1	0	0	75-100	30-50	20-50	10-30	---	NP
	4-32	Very cindery sand, very cindery loamy sand, cindery sand, very loamy sand.	SP, SP-SM	A-1	0	0	75-100	15-30	10-25	0-10	---	NP
	32-60	Silt loam, gravelly loam, sandy loam.	GM, ML, SM, MH	A-5, A-7	---	0-10	65-95	60-90	55-80	35-65	40-60	5-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO								
							4	10	40	200		
	In				Pct	Pct					Pct	
27, 28----- Cattcreek	0-7	Very cindery loamy sand.	SM, SP-SM	A-1	0	0	75-90	25-50	15-30	5-15	---	NP
	7-11	Very cindery sand, very cindery loamy sand.	SP-SM, SP	A-1	0	0	75-90	25-50	15-35	0-10	---	NP
	11-21	Extremely cindery sand, very cindery sand.	SP	A-1	0	0	70-90	10-35	5-20	0-5	---	NP
	21-60	Very gravelly sandy loam, extremely gravelly loam.	GM, GP-GM	A-1, A-2	---	10-35	20-35	10-35	10-20	5-20	25-45	NP-10
29, 30----- Cattcreek	0-7	Very cindery loamy sand.	SM, SP-SM	A-1	0	0	75-90	25-50	15-30	5-15	---	NP
	7-31	Very cindery sand, extremely cindery coarse sand.	SP-SM	A-1	0	0	75-90	20-50	10-30	5-10	---	NP
	31-60	Extremely gravelly sandy loam, very gravelly loam, very gravelly sandy loam.	GM, GP-GM	A-1, A-2	---	20-35	20-35	10-35	10-20	5-20	25-45	NP-10
31----- Cattcreek	0-8	Very cindery loamy sand.	SM, SP-SM	A-1	0	0	75-100	25-50	15-30	5-20	---	NP
	8-17	Extremely cindery sand, very cindery loamy sand, very cindery sand.	SP, SP-SM, SM	A-1	0	0	75-100	20-50	5-30	0-15	---	NP
	17-50	Extremely gravelly sandy loam, very gravelly silt loam, very gravelly loam.	GM	A-1, A-2	---	25-55	25-50	20-45	20-40	15-30	40-60	NP-15
	50	Cemented material.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct						
32, 33----- Cayuse	0-13	Sandy loam----	SM	A-2, A-4	0	0	85-100	80-100	40-60	30-50	25-30	NP-5
	13-30	Loam, sandy loam.	SM, ML	A-2, A-4	0	0	85-100	75-100	40-80	30-60	25-35	NP-5
	30-36	Gravelly loam, gravelly sandy loam.	SM	A-2, A-4	---	0-10	70-85	55-75	40-55	25-40	30-40	NP-10
	36-60	Very gravelly loam, gravelly loam, very gravelly sandy loam.	SM, GM	A-1, A-2	---	0-10	50-70	35-55	25-45	15-35	30-40	NP-10
34, 35, 36, 37, 38----- Chinkmin	0-8	Sandy loam----	SM	A-2, A-4	0	0	90-100	85-100	55-70	30-40	15-20	NP-5
	8-15	Gravelly loam, gravelly silt loam, very gravelly loam.	SC-SM	A-2, A-4	---	0-15	70-85	40-70	35-60	25-50	20-25	5-10
	15-22	Very cobbly loam, very gravelly loam, very gravelly sandy loam.	SM, GM	A-1, A-2	---	20-50	50-70	45-60	30-50	20-35	15-20	NP-5
	22-32	Very cobbly loam, extremely gravelly loam, very gravelly sandy loam.	SM, GM	A-1, A-2	---	0-40	50-70	25-60	25-50	10-35	15-20	NP-5
	32	Cemented material.	---	---	---	---	---	---	---	---	---	---
39, 40----- Christoff	0-12	Sandy loam----	SM	A-2, A-1	0	0	95-100	75-100	45-65	20-35	20-30	NP-5
	12-26	Sandy loam, gravelly sandy loam, loam.	SM, ML	A-6	0	0	95-100	70-95	65-85	45-65	35-40	10-15
	26-60	Clay loam, loam.	CL, SC	A-6	0	0	95-100	75-95	65-85	45-65	35-40	15-20
41, 42, 43---- Chuckanut	0-8	Loam-----	ML, SM	A-4	---	0-5	85-100	75-90	55-70	40-60	25-35	NP-5
	8-35	Gravelly loam, gravelly sandy loam.	SM	A-1, A-2, A-4	---	0-5	65-85	55-75	35-60	20-40	25-35	NP-5
	35-50	Gravelly loam, gravelly sandy loam.	SM	A-2, A-4	---	0-5	70-80	60-75	40-60	25-40	25-35	NP-5
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
44, 45, 46---- Cinebar	0-10	Silt loam-----	ML, MH	A-4, A-5, A-6, A-7	---	0-5	85-100	80-100	75-100	70-90	35-65	NP-20
	10-54	Silt loam-----	ML, MH	A-5, A-7	---	0-5	85-100	80-100	75-100	70-90	40-60	5-20
	54-60	Silt loam, loam.	ML, MH	A-5, A-7	---	0-5	85-100	80-100	75-100	65-90	40-60	5-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
47----- Cotteral	0-9	Very cindery sandy loam.	SM	A-1	0	0	75-100	25-50	15-35	10-20	---	NP
	9-32	Very cindery sandy loam, very cindery sand, very cindery loamy sand.	SM, SP-SM	A-1	0	0	75-100	25-50	15-35	5-15	---	NP
	32-60	Silt loam, sandy loam, loam.	SM, ML, MH	A-4, A-2, A-7, A-5	---	0-5	90-100	85-100	55-95	30-75	35-60	NP-20
48----- Cotteral	0-3	Very cindery sandy loam.	SM	A-1	0	0	75-100	25-50	15-35	10-20	---	NP
	3-14	Very cindery sandy loam, very cindery sand, very cindery loamy sand.	SM, SP-SM	A-1	0	0	75-100	25-50	15-35	5-15	---	NP
	14-60	Silt loam, sandy loam, loam.	SM, ML, MH	A-4, A-2, A-7, A-5	---	0-5	90-100	85-100	55-95	30-75	35-60	NP-20
49----- Crinker	0-5	Very channery loam.	GM, SM	A-1, A-2, A-4, A-5	---	0-5	50-70	30-50	25-45	20-40	35-45	NP-5
	5-32	Very channery silt loam, extremely channery loam, very channery loam.	GM-GC, GM	A-2, A-1	---	0-15	35-50	25-40	20-30	15-30	20-30	NP-10
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
50----- Cryofluvents	0-5	Stony sandy loam.	SM	A-1, A-2, A-4	---	10-20	65-95	50-90	35-60	15-45	20-30	NP-5
	5-9	Gravelly loamy sand, very gravelly sandy loam, cobbly loam.	SM, GM	A-1, A-2, A-4	---	5-20	50-80	40-70	20-55	15-45	15-20	NP-5
	9-49	Gravelly loamy sand, very gravelly loamy sand, very gravelly fine sand.	SM, GM	A-1	---	5-30	50-80	40-70	20-50	10-25	---	NP
	49	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
51----- Cryohemists	0-6	Muck-----	PT	A-8	0	0	---	---	---	---	---	---
	6-28	Hemic material	PT	A-8	0	0	---	---	---	---	---	---
	28-60	Clay loam, gravelly sandy loam, gravelly loam.	SM, ML	A-2, A-4	0	0	70-95	60-90	45-70	25-60	20-35	NP-10

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
52----- Dobbs	0-10	Loam-----	ML, MH, OL, OH	A-5, A-7	0	0	90-95	85-90	65-85	50-65	45-65	5-20
	10-35	Gravelly loam, very gravelly sandy loam, very gravelly loam.	GM, SM	A-5, A-2, A-7	---	10-25	45-75	35-65	25-50	15-40	40-60	5-20
	35	Cemented material.	---	---	---	---	---	---	---	---	---	---
53----- Edgewick	0-8	Silt loam----	ML	A-4	0	0	90-100	85-100	70-80	50-60	15-25	NP-5
	8-20	Fine sandy loam, silt loam, loam.	SM	A-4, A-2	0	0	90-100	85-100	60-80	30-50	15-25	NP-5
	20-46	Fine sandy loam, loamy sand, sand.	SM	A-2	0	0	90-100	75-100	60-80	15-35	---	NP
	46-60	Very gravelly sand, very gravelly loamy sand.	SP-SM, GP-GM, GM, SM	A-1	0	0	50-70	25-50	20-40	5-15	---	NP
54, 55----- Elwell	0-8	Silt loam----	ML, OL	A-4	---	0-5	85-100	75-90	60-80	50-65	30-40	NP-10
	8-35	Silt loam, loam, gravelly silt loam.	ML, SM	A-4	---	0-5	75-100	50-90	50-80	40-65	30-40	NP-10
	35	Cemented material.	---	---	---	---	---	---	---	---	---	---
56, 57----- Ethanias	0-7	Very cindery loamy sand.	SM	A-1	---	0-5	90-100	35-50	25-30	10-15	---	NP
	7-31	Very cindery loamy sand.	SM	A-1	---	0-5	90-100	35-50	25-30	10-15	---	NP
	31-60	Very gravelly loam, very gravelly sandy loam.	GM	A-1, A-2	---	10-25	50-65	40-55	30-45	15-30	30-45	NP-10
58, 59----- Ethanias	0-6	Very cindery loamy sand.	SM	A-1	---	0-5	90-100	35-50	25-30	10-15	---	NP
	6-14	Very cindery loamy sand.	SM	A-1	---	0-5	90-100	35-50	25-30	10-15	---	NP
	14-36	Very gravelly loam, very gravelly sandy loam.	GM	A-1, A-2	---	10-25	50-65	40-55	30-45	15-30	30-45	NP-10
	36-60	Very gravelly sandy loam, extremely cobbly loamy sand, very gravelly loamy sand.	GM	A-1, A-2	---	25-65	45-60	40-45	20-35	10-20	25-40	NP-10

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct						
60----- Ethanias	0-8	Very cindery loamy sand.	SM	A-1	---	0-5	90-100	35-50	15-30	10-15	---	NP
	8-15	Very cindery loamy sand, very cindery coarse sand.	SM, SP-SM	A-1	---	0-5	90-100	35-50	15-30	5-15	---	NP
	15-41	Very gravelly loam, very gravelly sandy loam.	GM	A-1, A-2	---	10-25	50-65	40-55	30-45	15-30	30-45	NP-10
	41	Cemented material.	---	---	---	---	---	---	---	---	---	---
61, 62----- Foss	0-4	Stony sandy loam.	SM	A-2	---	10-20	90-95	80-90	50-60	25-35	15-20	NP-5
	4-16	Gravelly sandy loam, gravelly loam.	SM	A-1, A-2, A-4	---	0-5	60-75	50-75	30-65	15-50	30-40	5-10
	16-60	Very gravelly silt loam, very gravelly loam, very cobbly silt loam.	SM, GM	A-2, A-4	---	10-50	60-80	35-55	30-50	25-50	30-40	5-10
63, 64----- Gallup	0-5	Loam-----	ML, OL	A-4, A-5	0	0	90-100	80-100	75-95	70-80	35-45	NP-5
	5-14	Silt loam, loam, gravelly loam.	ML	A-4	---	0-10	80-95	70-90	65-90	50-70	25-35	NP-5
	14-41	Gravelly silt loam, gravelly loam, loam.	SM, GM	A-4	---	0-15	65-90	55-80	45-60	35-50	25-35	NP-5
	41-60	Gravelly silt loam, gravelly loam, gravelly sandy loam.	SM, GM	A-1, A-2, A-4	---	0-5	60-85	50-75	40-60	20-45	20-30	NP-5
65----- Gallup	0-7	Loam-----	ML, OL	A-4, A-5	0	0	90-100	80-100	75-95	70-80	35-45	NP-5
	7-15	Silt loam, loam, gravelly loam.	ML	A-4	---	0-10	80-95	70-90	65-90	50-70	25-35	NP-5
	15-36	Gravelly silt loam, gravelly loam, loam.	SM, GM	A-4	---	0-15	65-90	55-80	45-60	35-50	25-35	NP-5
	36-60	Gravelly silt loam, gravelly loam, gravelly sandy loam.	SM, GM	A-1, A-2, A-4	---	0-5	60-85	50-75	40-60	20-45	20-30	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
66, 67, 68--- Getchell	0-7	Loam-----	ML, OL	A-4	---	0-5	90-100	85-95	70-90	55-80	30-40	NP-10
	7-19	Silt loam, loam, gravelly silt loam.	ML, GM, SM	A-4	---	0-5	65-100	50-95	40-85	35-80	30-40	NP-10
	19-30	Silt loam, sandy loam, gravelly loam.	SM, ML	A-2, A-4, A-1	---	0-5	65-100	50-95	40-85	20-80	30-40	NP-10
	30	Cemented material.	---	---	---	---	---	---	---	---	---	---
69----- Greenwater	0-5	Loamy sand----	SM	A-2, A-1	0	0	90-100	75-100	40-65	10-25	---	NP
	5-17	Loamy sand, sand.	SM, SP-SM	A-2, A-1, A-3	0	0	90-100	75-100	40-65	5-25	---	NP
	17-51	Sand, coarse sand.	SM, SP-SM	A-2, A-1, A-3	0	0	90-100	75-100	40-60	5-15	---	NP
	51-60	Extremely gravelly sand, very gravelly coarse sand, very gravelly sand.	GP, GP-GM, SP-SM, SP	A-1	---	0-10	25-60	15-50	10-25	0-10	---	NP
70----- Grotto	0-5	Gravelly loamy sand.	SM	A-1	---	0-5	65-85	55-75	30-40	10-20	---	NP
	5-19	Gravelly loamy sand, very gravelly loamy sand, very gravelly coarse sand.	SM, GM	A-1, A-2	---	0-5	50-80	35-70	30-60	10-20	---	NP
	19-36	Very gravelly loamy sand, very gravelly coarse sand, very gravelly sand.	SP, GP, GP-GM, SP-SM	A-1	---	0-5	40-70	30-50	15-30	0-10	---	NP
	36-60	Very gravelly sand, very gravelly coarse sand.	SP, SP-SM	A-1	---	10-25	65-80	35-55	10-30	0-10	---	NP
71----- Hartnit	0-6	Silt loam----	ML	A-4	---	0-10	90-100	80-90	65-80	50-65	30-40	NP-10
	6-20	Gravelly silt loam, gravelly loam, cobbly loam.	SM, GM, ML	A-2, A-4	---	0-30	65-85	60-75	45-70	30-60	30-40	NP-10
	20-31	Gravelly loam, very gravelly loam, very gravelly silt loam.	SM, GM, ML	A-2, A-4	---	0-15	60-85	40-75	35-70	25-60	30-40	NP-10
	31	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
					In						Pct	Pct
72, 73----- Haywire	0-4	Sandy loam----	SM	A-2, A-4	0	0	90-100	85-100	50-65	25-40	15-25	NP-5
	4-17	Loam, gravelly sandy loam, gravelly loam.	SM	A-1, A-2, A-4	---	0-10	75-95	60-90	40-80	20-50	25-35	NP-5
	17-25	Very cobbly loam, very gravelly loam.	GM, SM	A-2, A-4	---	10-30	55-75	50-65	40-55	25-40	30-40	NP-5
	25-36	Extremely gravelly loam, very gravelly silt loam, extremely cobbly loam.	GM	A-1, A-2	---	15-55	30-60	20-50	15-40	15-35	30-40	NP-5
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
74, 75----- Haywire	0-8	Loamy sand----	SM	A-1, A-2	0	0	90-100	85-100	40-60	15-25	---	NP
	8-14	Very cobbly loam, very gravelly loam.	GM, SM	A-2, A-4	---	10-30	55-75	50-65	40-55	25-40	30-40	NP-5
	14-30	Extremely gravelly loam, very gravelly silt loam, extremely cobbly loam.	GM	A-1, A-2	---	15-55	30-60	20-50	15-40	15-35	30-40	NP-5
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
76, 77, 78---- Hinker	0-8	Gravelly sandy loam.	SM	A-2, A-1	---	0-5	70-85	60-75	40-55	20-35	20-30	NP-5
	8-17	Very channery silt loam, very cobbly loam, very channery loam.	GM	A-2, A-4	---	15-25	50-70	35-55	30-50	25-40	30-40	NP-10
	17-38	Very channery silt loam, very channery loam, extremely channery loam.	GM	A-2, A-4	---	25-55	45-75	45-70	30-40	25-40	25-35	NP-5
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Frag-ments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
79----- Humaquepts	0-5	Silt loam----	ML, CL-ML	A-4	0	0	85-100	75-95	60-90	50-80	15-25	NP-10
	5-13	Sandy loam, silt loam, loam.	ML, SM, SC-SM, CL-ML	A-4, A-2	---	0-5	85-100	75-95	45-80	30-60	15-30	NP-10
	13-25	Gravelly sandy loam, loam, gravelly silty clay loam.	ML, CL, CL-ML, SM	A-4, A-2, A-6	---	0-10	75-95	60-90	40-85	25-80	15-40	NP-20
	25-60	Silty clay loam, gravelly sand, very gravelly loam.	ML, CL, CL-ML, SM	A-4, A-2, A-1, A-6	---	0-10	65-95	50-90	35-85	10-80	15-40	NP-20
80, 81, 82---- Index	0-7	Loamy sand----	SM	A-1, A-2	---	0-5	90-100	75-95	45-60	15-25	---	NP
	7-15	Very gravelly loamy sand, cobbly sand, very cobbly loamy sand.	GM, SM	A-1	---	25-45	50-85	45-80	30-45	10-20	---	NP
	15-23	Very gravelly loamy sand, very cobbly loamy sand, very cobbly sand.	GM, SM, SP-SM, GP-GM	A-1	---	20-45	50-65	45-60	30-40	5-15	---	NP
	23-57	Very cobbly sand, extremely cobbly sand, very gravelly sand.	SP, GP, SP-SM, GP-GM	A-1	---	25-60	45-60	35-55	25-35	0-10	---	NP
	57	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
83*: Index-----	0-7	Loamy sand----	SM	A-1, A-2	---	0-5	90-100	75-95	45-60	15-25	---	NP
	7-15	Very gravelly loamy sand, cobbly sand, very cobbly loamy sand.	GM, SM	A-1	---	25-45	50-85	45-80	30-45	10-20	---	NP
	15-23	Very gravelly loamy sand, very cobbly loamy sand, very cobbly sand.	GM, SM, SP-SM, GP-GM	A-1	---	20-45	50-65	45-60	30-40	5-15	---	NP
	23-57	Very cobbly sand, extremely cobbly sand, very gravelly sand.	SP, GP, SP-SM, GP-GM	A-1	---	25-60	45-60	35-55	25-35	0-10	---	NP
	57	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
84, 85----- Jonas	0-6	Gravelly loam	SM, ML, MH	A-4, A-5, A-6, A-7	---	0-5	70-85	55-75	40-65	35-55	35-55	5-20
	6-43	Cobbly loam, gravelly clay loam, gravelly loam.	SM, ML, MH	A-4, A-5, A-6, A-7	---	0-25	75-90	65-85	40-65	35-55	35-55	5-20
	43-54	Very gravelly loam, gravelly loam.	SM, GM	A-2	---	0-10	50-70	40-60	30-50	25-35	30-40	5-10
	54	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
86, 87, 88---- Jonas	0-16	Gravelly silt loam.	SM, ML, MH	A-5, A-7	---	0-5	80-85	55-75	50-70	40-65	40-65	5-20
	16-60	Cobbly loam, cobbly clay loam, gravelly clay loam.	ML, MH	A-5, A-7	---	10-30	90-95	70-80	65-75	50-65	40-60	5-20
89, 90, 91---- Kaleetan	0-4	Sandy loam----	SM	A-2, A-4	0	0	90-100	85-100	50-80	30-45	15-20	NP-5
	4-9	Gravelly sandy loam, gravelly loam.	SM	A-2, A-4, A-1	---	5-20	65-90	65-75	35-65	20-50	30-40	NP-5
	9-35	Very gravelly sandy loam, very gravelly loam.	GM	A-2, A-4	---	10-25	40-70	35-55	25-50	15-40	30-40	5-10
	35-60	Very gravelly sandy loam, very gravelly loamy sand, extremely gravelly sandy loam.	GP-GM, SP-SM, SM, GM	A-1	---	15-35	35-60	15-40	15-35	5-15	15-20	NP-5
92, 93----- Kaleetan	0-5	Sandy loam----	SM	A-2, A-4	0	0	90-100	85-100	50-80	30-45	15-20	NP-5
	5-12	Gravelly sandy loam, gravelly loam.	SM	A-2, A-4, A-5, A-6	---	5-10	65-80	65-75	35-65	20-50	30-45	5-15
	12-23	Very gravelly sandy loam, very gravelly loam.	GM	A-2, A-4	---	10-25	40-70	35-55	25-50	15-40	30-40	5-10
	23-41	Very gravelly sandy loam, very gravelly loamy sand, extremely gravelly sandy loam.	GP-GM, GM	A-1	---	15-35	35-60	15-40	15-35	5-20	15-20	NP-5
	41	Cemented material.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
94, 95----- Kaleetan	0-6	Sandy loam----	SM	A-2, A-4	0	0	90-100	85-100	50-80	30-45	15-20	NP-5
	6-17	Gravelly sandy loam, gravelly loam.	SM	A-2, A-4, A-1	---	5-20	65-90	65-75	35-65	20-50	30-40	NP-5
	17-34	Very gravelly sandy loam, very gravelly loam.	GM	A-2, A-4	---	10-25	40-70	35-55	25-50	15-40	30-40	5-10
	34-60	Very gravelly sandy loam, very gravelly loamy sand, extremely gravelly sandy loam.	GP-GM, SP-SM, SM, GM	A-1	---	15-35	35-60	15-40	15-35	5-15	15-20	NP-5
96, 97----- Kanaskat	0-11	Gravelly sandy loam.	SM	A-2, A-1	---	0-5	65-85	55-75	35-50	20-35	25-35	NP-5
	11-23	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM	A-2, A-1	---	0-10	40-65	20-55	15-45	10-35	30-40	NP-10
	23-38	Very gravelly sandy loam, extremely gravelly sandy loam.	GM	A-1, A-2	---	0-15	40-60	30-45	25-35	15-25	30-40	NP-10
	38-60	Very gravelly sandy loam, extremely gravelly sandy loam, extremely gravelly coarse sandy loam.	GM, GP-GM	A-1	---	5-15	25-50	15-40	10-30	5-20	25-35	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct						
98, 99----- Kanaskat	0-7	Gravelly sandy loam.	SM	A-2, A-1	---	0-5	65-85	55-75	35-50	20-35	25-35	NP-5
	7-18	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM	A-2, A-1	---	0-10	40-65	20-55	15-45	10-35	30-40	NP-10
	18-30	Very gravelly sandy loam, extremely gravelly sandy loam.	GM	A-1, A-2	---	0-15	40-60	30-45	25-35	15-25	30-40	NP-10
	30-60	Very gravelly sandy loam, extremely gravelly sandy loam, extremely gravelly coarse sandy loam.	GM, GP-GM	A-1	---	5-15	25-50	15-40	10-30	5-20	25-35	NP-5
100, 101, 102- Kapowsin	0-9	Gravelly loam	SM, ML, GM	A-4, A-5	---	0-5	65-85	55-75	50-65	35-60	30-50	NP-10
	9-24	Gravelly loam, silt loam, loam.	SM, ML	A-4, A-5	---	0-5	75-90	65-85	50-75	40-70	30-45	NP-10
	24-37	Gravelly loam, gravelly sandy loam, loam.	SM	A-4, A-2, A-1	---	0-10	65-90	55-85	35-65	20-50	15-25	NP-5
	37	Cemented material.	---	---	---	---	---	---	---	---	---	---
103, 104, 105- Kindy	0-6	Gravelly loam	SM	A-4	---	0-10	75-90	60-75	50-60	40-50	25-35	NP-5
	6-10	Gravelly loam, gravelly silt loam, very gravelly silt loam.	GM, ML	A-2, A-4	---	0-15	50-75	40-70	35-65	30-55	30-40	NP-5
	10-23	Very gravelly loam, very gravelly silt loam.	GM	A-1, A-2	---	0-15	45-65	30-45	20-40	15-35	30-40	NP-5
	23-32	Very gravelly loam, very gravelly sandy loam.	GM	A-1, A-2	---	0-25	45-65	30-45	20-40	10-35	15-25	NP-5
	32	Cemented material.	---	---	---	---	---	---	---	---	---	---
106----- Klaber	0-6	Silt loam-----	CL-ML	A-4	0	0	100	100	90-100	70-90	25-30	5-10
	6-22	Silty clay loam, silt loam, silty clay.	CL	A-7	0	0	100	100	95-100	80-95	40-50	15-25
	22-60	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	90-95	55-65	30-40

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
107*: Klaber-----	0-6	Silt loam-----	CL-ML	A-4	0	0	100	100	90-100	70-90	25-30	5-10
	6-22	Silty clay loam, silt loam, silty clay.	CL	A-7	0	0	100	100	95-100	80-95	40-50	15-25
	22-60	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	90-95	55-65	30-40
Cinebar-----	0-10	Silt loam-----	ML, MH	A-4, A-5, A-6, A-7	---	0-5	85-100	80-100	75-100	70-90	35-65	NP-20
	10-54	Silt loam-----	ML, MH	A-5, A-7	---	0-5	85-100	80-100	75-100	70-90	40-60	5-20
	54-60	Silt loam, loam.	ML, MH	A-5, A-7	---	0-5	85-100	80-100	75-100	65-90	40-60	5-20
108, 109----- Klapatche	0-8	Loamy sand-----	SM	A-1, A-2	---	0-5	80-100	80-95	40-60	15-25	---	NP
	8-12	Very gravelly sandy loam, gravelly silt loam, very gravelly loamy sand.	SM, GM	A-1, A-2, A-4	---	0-10	60-80	40-75	35-60	10-50	15-20	NP-5
	12-20	Gravelly sandy loam, extremely gravelly sand, very gravelly loamy sand.	SM, GM, SP-SM, GP-GM	A-1	---	0-15	35-80	30-70	15-35	5-15	---	NP
	20-31	Extremely cobbly sand, very cobbly sand, extremely gravelly sand.	GP, SP	A-1	---	25-50	35-60	30-55	10-25	0-5	---	NP
	31-38	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
110*: Klapatche----	0-8	Loamy sand----	SM	A-1, A-2	---	0-5	80-100	80-95	40-60	15-25	---	NP
	8-12	Very gravelly sandy loam, gravelly silt loam, very gravelly loamy sand.	SM, GM	A-1, A-2, A-4	---	0-10	60-80	40-75	35-60	10-50	15-20	NP-5
	12-20	Gravelly sandy loam, extremely gravelly sand, very gravelly loamy sand.	SM, GM, SP-SM, GP-GM	A-1	---	0-15	35-80	30-70	15-35	5-15	---	NP
	20-31	Extremely cobble sand, very cobble sand, extremely gravelly sand.	GP, SP	A-1	---	25-50	35-60	30-55	10-25	0-5	---	NP
	31-38	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
111, 112, 113, 114, 115----- Klaus	0-7	Sandy loam----	SM	A-2, A-4	0	0	90-100	90-100	55-70	30-40	15-20	NP-5
	7-16	Sandy loam, gravelly sandy loam.	SM	A-1, A-2	---	0-10	75-90	60-80	40-55	20-30	20-30	NP-5
	16-28	Very gravelly loamy sand, very gravelly sand, extremely gravelly sand.	GP, GP-GM	A-1	---	10-45	40-50	20-40	10-20	0-10	---	NP
	28	Cemented material.	---	---	---	---	---	---	---	---	---	---
116, 117----- Larrupin	0-6	Loamy sand----	SM	A-1, A-2	0	0	90-100	85-95	45-65	15-25	---	NP
	6-24	Loamy sand, gravelly loamy sand, gravelly sandy loam.	SM	A-1, A-2	---	0-10	75-90	65-85	40-60	15-35	15-20	NP-5
	24-35	Very gravelly sandy loam.	SM, GM	A-1	---	10-25	50-75	35-55	25-45	15-25	15-20	NP-5
	35-60	Very gravelly sandy loam, very gravelly loamy sand.	SM, GM	A-1	---	10-25	50-75	35-55	20-40	10-20	15-20	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
118----- Larrupin	0-6	Loamy sand----	SM	A-1, A-2	0	0	85-95	75-85	40-60	15-25	---	NP
	6-17	Cindery loamy sand, cindery sandy loam, loamy sand.	SM	A-2, A-1	---	0-5	90-95	55-85	35-75	15-35	---	NP
	17-35	Very cobbly loam, very gravelly loam.	SM, ML	A-2, A-5, A-7, A-6	---	30-65	70-90	40-75	35-70	25-60	35-50	5-15
	35-52	Very cobbly loam, very gravelly loam, very gravelly sandy loam.	SM	A-1, A-2, A-4	---	30-65	70-90	40-70	30-60	20-50	30-40	NP-10
	52	Cemented material.	---	---	---	---	---	---	---	---	---	---
119----- Lemolo	0-5	Silt loam-----	ML, OL	A-4	0	0	90-100	80-100	70-90	60-80	30-40	5-10
	5-17	Silt loam, loam.	ML	A-4	---	0-5	90-100	80-100	60-85	50-75	30-40	5-10
	17-60	Very gravelly sandy loam, extremely gravelly sandy clay loam, very gravelly sandy clay loam.	GC, GM-GC, GP-GC	A-2	---	5-25	30-55	20-45	15-35	5-15	20-35	5-15
120, 121, 122- Littlejohn	0-11	Gravelly sandy loam.	SM	A-2	---	10-15	75-90	50-85	35-50	20-30	30-40	5-10
	11-17	Very gravelly loam, very gravelly sandy loam, gravelly sandy loam.	SM, GM	A-2	---	10-15	40-90	30-85	20-60	15-35	30-40	5-10
	17-30	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM	A-2	---	15-30	30-50	20-40	15-35	10-25	30-40	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
123, 124----- Littlejohn	0-7	Gravelly sandy loam.	SM	A-2	---	10-15	75-90	50-85	35-50	20-30	30-40	5-10
	7-18	Gravelly loam, very gravelly sandy loam, gravelly sandy loam.	SM, GM	A-2	---	10-15	40-90	30-85	20-60	15-35	30-40	5-10
	18-27	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM	A-2	---	15-30	30-50	20-40	15-35	10-25	30-40	5-10
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
125----- Littlejohn	0-11	Gravelly sandy loam.	SM	A-2	---	10-15	75-90	50-85	35-50	20-30	30-40	5-10
	11-30	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM	A-2	---	15-30	30-50	20-40	15-35	10-25	30-40	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
126*: Littlejohn---	0-11	Gravelly sandy loam.	SM	A-2	---	10-15	75-90	50-85	35-50	20-30	30-40	5-10
	11-17	Very gravelly loam, very gravelly sandy loam, gravelly sandy loam.	SM, GM	A-2	---	10-15	40-90	30-85	20-60	15-35	30-40	5-10
	17-30	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM	A-2	---	15-30	30-50	20-40	15-35	10-25	30-40	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
127----- Lynnwood	0-6	Loamy fine sand.	SM	A-2	0	0	95-100	90-100	50-80	20-35	---	NP
	6-21	Loamy sand, loamy fine sand.	SM	A-2	0	0	80-100	75-100	50-75	15-35	---	NP
	21-60	Loamy sand, fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0	80-100	75-100	40-75	0-30	---	NP
128, 129----- Marblemount	0-5	Gravelly loamy sand.	SM	A-1, A-2	---	0-5	75-90	60-75	40-55	15-30	---	NP
	5-35	Very gravelly loamy sand, very stony loamy sand, extremely gravelly loamy sand.	SM, GM, GP-GM, SP-SM	A-1	---	10-40	45-65	30-50	15-30	5-15	---	NP
	35	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
130----- Marblemount	0-7	Gravelly loamy sand.	SM	A-1	---	0-5	75-90	60-75	40-50	15-20	---	NP
	7-16	Very gravelly sandy loam, very gravelly loamy sand.	GM, GP-GM	A-1	---	0-10	35-50	30-40	10-20	5-15	---	NP
	16-38	Very gravelly loamy sand, extremely gravelly loamy sand.	GP-GM	A-1	---	0-10	30-40	20-30	10-20	5-10	---	NP
	38	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
131*: Marblemount--	0-5	Gravelly loamy sand.	SM	A-1, A-2	---	0-5	75-90	60-75	40-55	15-30	---	NP
	5-35	Very gravelly loamy sand, very stony loamy sand, extremely gravelly loamy sand.	SM, GM, GP-GM, SP-SM	A-1	---	10-40	45-65	30-50	15-30	5-15	---	NP
	35	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
132, 133----- Mashel	0-7	Silt loam-----	ML	A-4	0	0	95-100	85-100	80-95	70-90	30-40	5-10
	7-13	Loam, silt loam.	ML	A-4	0	0	95-100	85-100	80-95	50-85	30-40	5-10
	13-60	Silty clay, silty clay loam, clay loam.	ML, MH	A-7	0	0	95-100	85-100	75-100	65-95	45-55	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct						
134, 135, 136- Melakwa	0-7	Sandy loam----	SM	A-4	0	0	80-90	75-85	55-65	35-45	30-35	NP-5
	7-22	Very gravelly sandy loam, very gravelly loam.	GM, SM	A-2	---	10-30	45-70	35-55	25-40	15-30	30-40	5-10
	22-37	Very gravelly sandy loam, very gravelly loam, extremely gravelly loam.	GP-GM, GM	A-2	---	15-35	30-55	15-40	10-35	5-25	30-40	5-10
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
137----- Melakwa	0-8	Sandy loam----	SM	A-4	0	0	80-90	75-85	55-65	35-45	30-35	NP-5
	8-18	Very gravelly sandy loam, very gravelly loam.	GM, SM	A-2	---	10-30	45-70	35-55	25-40	15-30	30-40	5-10
	18-31	Very gravelly sandy loam, very gravelly loam, extremely gravelly loam.	GP-GM, GM	A-2	---	15-35	30-55	15-40	10-35	5-25	30-40	5-10
	31	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
138*: Melakwa-----	0-7	Sandy loam----	SM	A-4	0	0	80-90	75-85	55-65	35-45	30-35	NP-5
	7-22	Very gravelly sandy loam, very gravelly loam.	GM, SM	A-2	---	10-30	45-70	35-55	25-40	15-30	30-40	5-10
	22-37	Very gravelly sandy loam, very gravelly loam, extremely gravelly loam.	GP-GM, GM	A-2	---	15-35	30-55	15-40	10-35	5-25	30-40	5-10
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
139----- Mowich	0-7	Silt loam----	ML	A-4	0	0	90-100	80-100	80-100	70-90	30-40	NP-5
	7-26	Silt loam----	ML	A-4, A-5	0	0	90-100	80-100	80-100	70-80	35-45	5-10
	26-60	Silty clay, clay.	CH, MH	A-7	---	0-5	85-100	75-100	75-95	70-90	50-70	25-35
140----- Mukilteo	0-10	Peat-----	PT	A-8	0	0	---	---	---	---	---	---
	10-60	Hemic material	PT	A-8	0	0	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
141, 142----- Nagrom	0-4	Sandy loam----	SM	A-2, A-4	0	0	100	100	60-70	30-40	---	NP
	4-7	Sandy loam, loam, gravelly loam.	SM	A-1, A-2, A-4	---	0-5	75-90	50-85	30-70	20-50	25-35	NP-5
	7-23	Gravelly loam, very gravelly loam, gravelly sandy loam.	SM	A-2, A-4	---	10-15	75-80	35-60	30-50	20-45	25-35	NP-5
	23-38	Very gravelly loam, very gravelly silt loam.	GM	A-1, A-2	---	10-20	45-60	30-45	25-40	20-35	25-35	NP-5
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
143, 144----- Nagrom	0-4	Gravelly loam	SM	A-2, A-4, A-1	0	0	75-90	55-75	30-60	20-45	25-35	NP-5
	4-10	Sandy loam, loam, gravelly loam.	SM	A-2, A-4	---	0-5	70-90	55-80	35-65	25-45	25-35	NP-5
	10-25	Very gravelly loam, very gravelly sandy loam.	GM	A-1, A-2	---	0-5	40-60	30-50	20-45	15-35	25-35	NP-5
	25-34	Very gravelly loam, very gravelly silt loam, extremely gravelly silt loam.	GM, GP-GM	A-1, A-2	---	0-5	30-55	20-45	15-40	10-30	25-35	NP-5
	34	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
145*: Nagrom-----	0-4	Sandy loam----	SM	A-2, A-4	0	0	100	100	60-70	30-40	---	NP
	4-7	Sandy loam, loam, gravelly loam.	SM	A-1, A-2, A-4	---	0-5	75-90	50-85	30-70	20-50	25-35	NP-5
	7-23	Gravelly loam, very gravelly loam, gravelly sandy loam.	SM	A-2, A-4	---	10-15	75-80	35-60	30-50	20-45	25-35	NP-5
	23-38	Very gravelly loam, very gravelly silt loam.	GM	A-1, A-2	---	10-20	45-60	30-45	25-40	20-35	25-35	NP-5
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct						
146, 147----- Nargar	0-2	Fine sandy loam.	ML, SM	A-4	0	0	90-100	85-100	65-90	35-60	25-35	NP-5
	2-24	Loam, fine sandy loam, sandy loam.	ML, SM	A-4	0	0	90-100	85-100	50-90	35-70	25-40	NP-10
	24-60	Loamy fine sand, sand, gravelly coarse sand.	SM, SP-SM	A-1	0	0	60-100	50-90	25-50	0-25	---	NP
148*: Nargar-----	0-2	Fine sandy loam.	ML, SM	A-4	0	0	90-100	85-100	65-90	35-60	25-35	NP-5
	2-24	Loam, fine sandy loam, sandy loam.	ML, SM	A-4	0	0	90-100	85-100	50-90	35-70	25-40	NP-10
	24-60	Loamy fine sand, sand, gravelly coarse sand.	SM, SP-SM	A-1	0	0	60-100	50-90	25-50	0-25	---	NP
Pastik-----	0-6	Silt loam-----	ML	A-4, A-5	0	0	100	100	85-100	75-90	35-45	5-10
	6-31	Silt loam, loam, very fine sandy loam.	ML	A-4, A-5	0	0	100	100	85-100	70-80	35-45	5-10
	31-60	Silt loam, silty clay loam, very fine sandy loam.	ML	A-4, A-6	0	0	100	100	80-90	70-90	30-40	5-15
149----- National	0-10	Cindery sandy loam.	SM	A-2, A-1	0	0	75-100	50-75	30-50	15-30	---	NP
	10-28	Very cindery sand, very cindery sandy loam, very cindery loamy sand.	SM, SP-SM	A-1	0	0	75-100	25-50	15-30	5-15	---	NP
	28-46	Loam, sandy loam, fine sandy loam.	SM, ML	A-4, A-2	---	0-5	85-95	80-90	55-75	25-55	25-40	NP-10
	46-60	Silt loam, gravelly sandy loam.	ML, SM	A-4, A-2, A-1	---	0-5	90-100	50-80	35-75	20-60	25-40	NP-10
150----- Neilton	0-16	Gravelly loamy sand.	SM	A-2, A-1	---	0-10	60-70	55-65	35-55	15-25	---	NP
	16-21	Very gravelly loamy sand, extremely gravelly sand, extremely cobbly sand.	GP-GM	A-1	---	20-45	40-50	20-50	10-25	5-10	---	NP
	21-60	Very gravelly sand, very gravelly loamy sand, extremely cobbly sand.	GP, GP-GM	A-1	---	10-35	35-55	20-50	10-25	0-10	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
151, 152, 153- Nimue	0-5	Loamy sand----	SM	A-2	0	0	90-100	90-100	50-70	15-25	---	NP
	5-10	Loamy sand, sandy loam.	SM	A-2, A-4	0	0	90-100	85-100	50-70	15-40	---	NP
	10-24	Very gravelly sandy loam, very gravelly loam, extremely gravelly sandy loam.	GM, GP-GM	A-1, A-2	---	15-30	30-60	15-45	10-45	5-35	20-30	NP-5
	24-60	Extremely gravelly loam, extremely gravelly sandy loam, extremely gravelly silt loam.	GM, GP-GM	A-1	---	15-35	25-50	15-30	10-25	5-20	20-30	NP-5
154, 155----- Nimue	0-6	Loamy sand----	SM	A-2	0	0	90-100	90-100	50-70	15-25	---	NP
	6-15	Loamy sand, sandy loam.	SM	A-2, A-4	0	0	90-100	85-100	50-70	15-40	---	NP
	15-32	Very gravelly sandy loam, very gravelly loam, extremely gravelly sandy loam.	GM, GP-GM	A-1, A-2	---	15-30	30-60	15-45	10-45	5-35	20-30	NP-5
	32-60	Extremely gravelly loam, extremely gravelly sandy loam, extremely gravelly silt loam.	GM, GP-GM	A-1	---	15-35	25-50	15-30	10-25	5-20	20-30	NP-5
156*: Nimue-----	0-5	Loamy sand----	SM	A-2	0	0	90-100	90-100	50-70	15-25	---	NP
	5-10	Loamy sand, sandy loam.	SM	A-2, A-4	0	0	90-100	85-100	50-70	15-40	---	NP
	10-24	Very gravelly sandy loam, very gravelly loam, extremely gravelly sandy loam.	GM, GP-GM	A-1, A-2	---	15-30	30-60	15-45	10-45	5-35	20-30	NP-5
	24-60	Extremely gravelly loam, extremely gravelly sandy loam, extremely gravelly silt loam.	GM, GP-GM	A-1	---	15-35	25-50	15-30	10-25	5-20	20-30	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
156*: Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
157----- Nooksack	0-11 11-29 29-60	Silt loam----- Silt loam----- Silt loam-----	ML ML ML	A-4 A-4 A-4	0 0 0	0 0 0	100 100 100	100 100 100	95-100 95-100 95-100	75-85 75-90 75-85	20-30 20-30 20-30	NP-5 NP-5 NP-5
158----- Norma	0-9 9-33 33-60	Loam----- Loam, gravelly sandy loam, gravelly loam. Very gravelly sandy loam.	ML SM, GM GM, SM	A-4 A-2, A-4 A-1	0 0 0	0 0 0-5	90-100 60-90 45-60	85-100 55-85 30-50	55-75 45-65 25-50	50-70 25-50 10-25	15-25 15-20 ---	NP-5 NP-5 NP
159----- Oakes	0-8 8-60	Gravelly loam Very gravelly loam, very gravelly sandy loam, extremely gravelly sandy loam.	GM, SM GM	A-4 A-2, A-1	--- ---	0-5 5-30	60-80 35-50	55-75 25-45	50-60 20-40	35-50 10-30	25-35 30-40	NP-10 NP-10
160----- Oakes	0-6 6-44 44	Cobbly loam--- Very cobbly silt loam, very gravelly sandy loam, extremely gravelly sandy loam. Cemented material.	SM GM ---	A-4 A-2, A-1 ---	--- --- ---	15-30 20-30 ---	80-100 35-60 ---	70-90 25-50 ---	60-70 20-40 ---	40-50 10-30 ---	30-40 30-40 ---	NP-10 NP-10 ---
161----- Oakes	0-6 6-44 44	Cobbly loam--- Very cobbly silt loam, very gravelly sandy loam, extremely gravelly sandy loam. Cemented material.	SM GM ---	A-4 A-2, A-1 ---	--- --- ---	15-30 20-30 ---	80-100 35-60 ---	70-90 25-50 ---	60-70 20-40 ---	40-50 10-30 ---	30-40 30-40 ---	NP-10 NP-10 ---
162, 163----- Ogarty	0-4 4-37 37	Gravelly loam Very gravelly sandy loam, very gravelly fine sandy loam, extremely gravelly fine sandy loam. Unweathered bedrock.	SM GP-GM, GM ---	A-4, A-2 A-1 ---	--- --- ---	0-5 0-20 ---	70-80 10-35 ---	55-75 5-35 ---	40-60 5-30 ---	30-40 5-20 ---	30-40 30-40 ---	NP-5 NP-5 ---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
164*: Ogarty-----	0-4	Gravelly loam	SM	A-4, A-2	---	0-5	70-80	55-75	40-60	30-40	30-40	NP-5
	4-37	Very gravelly sandy loam, very gravelly fine sandy loam, extremely gravelly fine sandy loam.	GP-GM, GM	A-1	---	0-20	10-35	5-35	5-30	5-20	30-40	NP-5
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
165----- Ohop	0-7	Sandy loam----	SM	A-2	0	0	90-100	85-100	45-75	25-35	20-30	NP-5
	7-16	Very gravelly sandy loam, very gravelly loam, extremely gravelly sandy loam.	GM	A-1, A-2	---	10-30	35-60	25-50	20-40	10-30	15-25	NP-5
	16-60	Very gravelly sandy loam, extremely gravelly sandy loam, very cobbly sandy loam.	GM	A-1, A-2	---	20-35	35-60	25-50	20-40	10-30	15-25	NP-5
166----- Ohop	0-7	Very gravelly loam.	GC, GM-GC	A-2	---	0-5	40-60	30-50	25-45	20-35	25-35	5-15
	7-16	Very gravelly sandy loam, very gravelly loam, extremely gravelly sandy loam.	GM	A-1, A-2	---	10-30	35-60	25-50	20-40	10-30	15-25	NP-5
	16-60	Very gravelly sandy loam, extremely gravelly sandy loam, very cobbly sandy loam.	GM	A-1, A-2	---	20-35	35-60	25-50	20-40	10-30	15-25	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
167, 168----- Olomount	0-6	Gravelly loam	GM, SM	A-2, A-4	---	0-10	60-80	55-75	40-60	30-50	30-40	NP-5
	6-14	Gravelly silt loam, gravelly loam, cobbly loam.	GM, SM	A-2, A-4	---	0-25	60-80	60-75	40-60	30-50	30-40	NP-5
	14-33	Very gravelly silt loam, very gravelly loam, extremely gravelly loam.	GM, GP-GM	A-1, A-2	---	0-25	20-50	10-40	10-35	10-30	30-40	NP-5
	33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
169*: Olomount-----	0-6	Gravelly loam	GM, SM	A-2, A-4	---	0-10	60-80	55-75	40-60	30-50	30-40	NP-5
	6-14	Gravelly silt loam, gravelly loam, cobbly loam.	GM, SM	A-2, A-4	---	0-25	60-80	60-75	40-60	30-50	30-40	NP-5
	14-33	Very gravelly silt loam, very gravelly loam, extremely gravelly loam.	GM, GP-GM	A-1, A-2	---	0-25	20-50	10-40	10-35	10-30	30-40	NP-5
	33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
170----- Oridia	0-11	Silt loam-----	ML	A-4	0	0	100	100	95-100	90-100	25-35	NP-10
	11-19	Silt loam, very fine sandy loam.	ML	A-4	0	0	100	100	95-100	85-100	25-35	NP-10
	19-60	Silt loam, silty clay loam, very fine sandy loam.	ML, CL	A-4, A-6, A-7	0	0	100	100	95-100	85-100	25-45	NP-20
171*: Orthents-----	0-6	Very cobbly sandy loam.	SM, GM	A-1, A-2	0	15-25	55-90	40-85	25-60	15-30	15-25	NP-5
	6-24	Very gravelly sandy loam, very cobbly loamy sand.	GM, SM, GP-GM, SP-SM	A-1	0	10-55	50-90	35-80	25-50	10-25	15-20	NP-5
	24-30	Extremely stony loamy sand, very gravelly sandy loam.	GM, SM, GP-GM, SP-SM	A-1	25-40	5-35	40-90	20-75	15-45	5-20	15-20	NP-5
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
171*: Humods-----	0-5	Very gravelly sandy loam.	SM, GM	A-1	---	10-30	50-75	35-50	20-45	15-25	15-25	NP-5
	5-14	Very gravelly sandy loam, very cobbly loamy sand, extremely stony sandy loam.	SM, GM	A-1	---	25-55	50-90	35-70	20-50	10-25	---	NP
	14-26	Extremely stony sandy loam, very gravelly loamy sand, extremely stony loam.	SM, GM, GP-GM, SP-SM	A-1	---	25-65	40-90	20-65	15-45	5-25	---	NP
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
172, 173----- Ovall	0-3	Gravelly loam	SM	A-4	---	0-10	70-85	55-75	50-70	35-50	20-30	NP-5
	3-24	Very gravelly loam, very gravelly sandy loam.	SM, GM	A-1, A-2	---	0-25	55-75	30-50	25-45	15-35	15-25	NP-5
	23	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
174----- Pastik	0-6	Silt loam-----	ML	A-4, A-5	0	0	100	100	85-100	75-90	35-45	5-10
	6-31	Silt loam, loam, very fine sandy loam.	ML	A-4, A-5	0	0	100	100	85-100	70-80	35-45	5-10
	31-60	Silt loam, silty clay loam.	ML	A-4, A-6	0	0	100	100	80-90	70-90	30-40	5-15
175, 176----- Persis	0-4	Sandy loam----	SM	A-4	0	0	95-100	90-100	50-70	35-45	25-30	NP-5
	4-13	Sandy loam, loam.	SM, ML	A-4	0	0	90-100	85-100	50-80	35-60	30-40	NP-5
	13-29	Sandy loam, loam.	SM, ML	A-2, A-4	0	0	85-100	75-100	40-75	25-60	30-40	NP-5
	29-60	Sand, gravelly sand, loamy sand.	SM, SP-SM	A-1, A-2	---	0-5	80-100	60-100	20-50	5-30	---	NP
177, 178----- Pheaney	0-11	Gravelly loam	SM, ML, MH	A-5, A-7	0	0	70-80	55-75	50-70	35-55	40-60	5-20
	11-34	Very gravelly loam, extremely cobbly silt loam, extremely gravelly loam.	GM	A-5, A-2, A-1, A-7	---	15-65	35-65	25-60	20-55	15-45	40-60	5-20
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct						
179, 180----- Pheeney	0-4	Gravelly silt loam.	SM, ML, MH	A-5, A-7	0	0	70-80	55-75	50-70	35-55	40-60	5-20
	4-12	Gravelly silt loam, gravelly loam.	SM, ML, MH	A-5, A-7	0	0	70-80	55-75	50-70	35-55	40-60	5-20
	12-34	Very gravelly loam, extremely gravelly silt loam, extremely gravelly loam.	GM	A-1, A-2	---	0-15	30-50	25-45	20-40	15-35	40-60	5-20
	34	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
181*: Pheeney-----	0-11	Gravelly loam	SM, ML, MH	A-5, A-7	0	0	70-80	55-75	50-70	35-55	40-60	5-20
	11-34	Very gravelly loam, extremely cobbly silt loam, extremely gravelly loam.	GM	A-5, A-2, A-1, A-7	---	15-65	35-65	25-60	20-55	15-45	40-60	5-20
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
	Rock outcrop-	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
182, 183----- Philippa	0-4	Sandy loam----	SM	A-2, A-4	0	0	90-100	85-100	55-70	30-40	30-40	NP-5
	4-9	Silt loam, gravelly silt loam, gravelly loam.	ML, MH	A-5	---	0-5	75-90	70-85	65-80	50-65	45-55	NP-5
	9-18	Gravelly loam, gravelly silt loam, very gravelly loam.	GM, SM	A-2, A-5	---	0-10	50-80	45-75	40-70	30-50	40-50	NP-5
	18-28	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM	A-1	---	10-30	40-45	30-40	20-35	10-25	35-45	NP-5
	28	Cemented material.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
184----- Pierking	0-6	Gravelly sandy loam.	SM, SC-SM	A-1, A-2	---	0-5	70-85	60-75	35-50	15-25	20-30	NP-10
	6-34	Very gravelly sandy loam, gravelly sandy loam.	GM, GM-GC, SM, SC-SM	A-1, A-2	---	0-5	40-70	30-60	20-40	10-30	10-20	NP-10
	34-60	Very gravelly sandy loam, very gravelly loamy sand.	GM, GP-GM	A-1	---	0-10	35-60	25-50	10-30	5-20	10-20	NP-5
185*: Pierking-----	0-6	Gravelly sandy loam.	SM, SC-SM	A-1, A-2	---	0-5	70-85	60-75	35-50	15-25	20-30	NP-10
	6-34	Very gravelly sandy loam, gravelly sandy loam.	GM, GM-GC, SM, SC-SM	A-1, A-2	---	0-5	40-70	30-60	20-40	10-30	10-20	NP-10
	34-60	Very gravelly sandy loam, very gravelly loamy sand.	GM, GP-GM	A-1	---	0-10	35-60	25-50	10-30	5-20	10-20	NP-5
Borohemists--	0-4	Mucky-peat----	PT	A-8	0	0	---	---	---	---	---	---
	4-30	Hemic material	PT	A-8	0	0	---	---	---	---	---	---
	30-60	Variable-----	---	---	---	---	---	---	---	---	---	---
186*: Pierking-----	0-6	Gravelly sandy loam.	SM, SC-SM	A-1, A-2	---	0-5	70-85	60-75	35-50	15-25	20-30	NP-10
	6-34	Very gravelly sandy loam, gravelly sandy loam.	GM, GM-GC, SM, SC-SM	A-1, A-2	---	0-5	40-70	30-60	20-40	10-30	10-20	NP-10
	34-60	Very gravelly sandy loam, very gravelly loamy sand.	GM, GP-GM	A-1	---	0-10	35-60	25-50	10-30	5-20	10-20	NP-5
Mowich-----	0-7	Silt loam-----	ML	A-4	0	0	90-100	80-100	80-100	70-90	30-40	NP-5
	7-26	Silt loam-----	ML	A-4, A-5	0	0	90-100	80-100	80-100	70-80	35-45	5-10
	26-60	Silty clay, clay.	CH, MH	A-7	---	0-5	85-100	75-100	75-95	70-90	50-70	25-35
187----- Pilchuck	0-9	Loamy fine sand.	SM	A-1, A-2	0	0	80-100	75-100	45-65	10-30	---	NP
	9-55	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2	0	0	80-100	75-100	50-80	5-15	---	NP
	55-60	Gravelly sand, very gravelly sand, gravelly coarse sand.	SP, GP	A-1	---	5-15	35-80	30-75	10-40	0-5	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
188, 189, 190- Pitcher	0-8	Sandy loam----	SM	A-2	0	0	95-100	75-100	45-60	25-35	15-20	NP-5
	8-16	Gravelly sandy loam, gravelly loam.	SM	A-2, A-4, A-1	0	0	75-85	60-75	40-55	20-45	20-30	NP-5
	16-29	Very gravelly sandy loam, very gravelly loam.	SM, GM	A-1, A-2	---	0-25	60-70	40-50	30-45	20-35	20-30	NP-5
	29-60	Extremely gravelly sandy loam, very gravelly loam, extremely cobbly loam.	GM	A-1, A-2	---	10-40	40-55	15-45	10-35	10-30	20-30	NP-5
191, 192, 193- Pitcher	0-7	Sandy loam----	SM	A-2	0	0	95-100	75-100	45-60	25-35	15-20	NP-5
	7-13	Gravelly sandy loam, gravelly loam.	SM	A-2, A-4, A-1	0	0	75-85	60-75	40-55	20-45	20-30	NP-5
	13-29	Very gravelly sandy loam, very gravelly loam.	SM, GM	A-1, A-2	---	0-25	60-70	40-50	30-45	20-35	20-30	NP-5
	29-60	Extremely gravelly sandy loam, very gravelly loam, extremely cobbly loam.	GM	A-1, A-2	---	10-40	40-55	15-45	10-35	10-30	20-30	NP-5
194*: Pitcher-----	0-8	Sandy loam----	SM	A-2	0	0	95-100	75-100	45-60	25-35	15-20	NP-5
	8-16	Gravelly sandy loam, gravelly loam.	SM	A-2, A-4, A-1	0	0	75-85	60-75	40-55	20-45	20-30	NP-5
	16-29	Very gravelly sandy loam, very gravelly loam.	SM, GM	A-1, A-2	---	0-25	60-70	40-50	30-45	20-35	20-30	NP-5
	29-60	Extremely gravelly sandy loam, very gravelly loam, extremely cobbly loam.	GM	A-1, A-2	---	10-40	40-55	15-45	10-35	10-30	20-30	NP-5
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
195*----- Pits	0-60	Variable-----	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
196, 197, 198- Playco	0-6	Loamy sand----	SM	A-2	0	0	90-100	85-100	50-70	15-30	---	NP
	6-10	Loamy sand, sandy loam.	SM	A-2, A-4	0	0	90-100	85-100	50-70	15-40	---	NP
	10-36	Very gravelly sandy loam, very gravelly loam, extremely gravelly loam.	SM, GM	A-2	---	5-20	40-70	25-50	15-45	10-35	40-50	10-20
	36-60	Extremely gravelly sandy loam, very gravelly loam, extremely gravelly loam.	GM	A-2	---	15-30	30-60	25-45	15-40	10-30	40-50	10-20
199, 200----- Playco	0-7	Very gravelly loamy sand.	GM, SM	A-1	0	0	50-70	40-60	30-40	10-15	---	NP
	7-17	Very gravelly loamy sand.	GM, SM	A-1	0	0	45-70	35-60	25-40	10-15	---	NP
	17-50	Very gravelly sandy loam, very gravelly loam, extremely gravelly sandy loam.	SM, GM	A-2, A-1	---	0-5	50-70	25-50	15-45	10-30	---	NP
	50-60	Extremely gravelly sandy loam, very gravelly loam, extremely gravelly loam.	GM	A-2, A-1	---	15-30	30-60	25-45	15-40	10-30	20-30	NP-5
201*: Playco-----	0-6	Loamy sand----	SM	A-2	0	0	90-100	85-100	50-70	15-30	---	NP
	6-10	Loamy sand, sandy loam.	SM	A-2, A-4	0	0	90-100	85-100	50-70	15-40	---	NP
	10-36	Very gravelly sandy loam, very gravelly loam, extremely gravelly sandy loam.	SM, GM	A-2	---	5-20	40-70	25-50	15-45	10-35	40-50	10-20
	36-60	Extremely gravelly sandy loam, very gravelly loam, extremely gravelly loam.	GM	A-2	---	15-30	30-60	25-45	15-40	10-30	40-50	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
201*: Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
202----- Puget	0-7	Silty clay loam.	CL, ML	A-7, A-6	0	0	100	100	95-100	85-95	35-45	10-20
	7-45	Silty clay loam, silt loam.	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	85-95	25-40	5-20
	45-60	Silty clay loam, silty clay, silt loam.	CL, CL-ML	A-6, A-4	0	0	100	100	95-100	85-95	25-40	5-20
203, 204----- Ragnar	0-13	Loam-----	ML	A-4, A-5	0	0	95-100	90-100	70-90	50-80	30-50	NP-10
	13-24	Fine sandy loam, sandy loam.	SM	A-4	0	0	95-100	75-100	60-85	35-50	20-40	NP-10
	24-60	Loamy sand, sand.	SM, SP, SP-SM	A-2, A-1, A-3	0	0	95-100	85-95	45-70	0-20	---	NP
205*: Ragnar-----	0-13	Loam-----	ML	A-4, A-5	0	0	95-100	90-100	70-90	50-80	30-50	NP-10
	13-24	Fine sandy loam, sandy loam.	SM	A-4	0	0	95-100	75-100	60-85	35-50	20-40	NP-10
	24-60	Loamy sand, sand.	SM, SP, SP-SM	A-2, A-1, A-3	0	0	95-100	85-95	45-70	0-20	---	NP
Lynnwood-----	0-6	Loamy fine sand.	SM	A-2	0	0	95-100	90-100	50-80	20-35	---	NP
	6-26	Loamy sand, loamy fine sand.	SM	A-2	0	0	80-100	75-100	50-75	15-35	---	NP
	26-60	Loamy sand, fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0	80-100	75-100	40-75	0-30	---	NP
206*: Ragnar-----	0-13	Loam-----	ML	A-4, A-5	0	0	95-100	90-100	70-90	50-80	30-50	NP-10
	13-24	Fine sandy loam, sandy loam.	SM	A-4	0	0	95-100	75-100	60-85	35-50	20-40	NP-10
	24-60	Loamy sand, sand.	SM, SP, SP-SM	A-2, A-1, A-3	0	0	95-100	85-95	45-70	0-20	---	NP
Lynnwood-----	0-6	Loamy fine sand.	SM	A-2	0	0	95-100	90-100	50-80	20-35	---	NP
	6-26	Loamy sand, loamy fine sand.	SM	A-2	0	0	80-100	75-100	50-75	15-35	---	NP
	26-60	Loamy sand, fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3, A-1	0	0	80-100	75-100	40-75	0-30	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
207----- Reggad	0-8	Very cobbly muck.	PT	A-8	---	50-75	---	---	---	---	---	---
	8-17	Very cobbly sapric material.	PT	A-8	---	50-70	---	---	---	---	---	NP
	17-60	Fragmental material.	GP	A-1	---	80-85	25-40	0-5	0-5	---	---	NP
208*: Reggad-----	0-8	Very cobbly muck.	PT	A-8	---	50-75	---	---	---	---	---	---
	8-17	Very cobbly sapric material.	PT	A-8	---	50-70	---	---	---	---	---	NP
	17-60	Fragmental material.	GP	A-1	---	80-85	25-40	0-5	0-5	---	---	NP
Haywire-----	0-4	Sandy loam-----	SM	A-2, A-4	0	0	90-100	85-100	50-65	25-40	15-25	NP-5
	4-17	Loam, gravelly sandy loam, gravelly loam.	SM	A-1, A-2, A-4	---	0-10	75-95	60-90	40-80	20-50	25-35	NP-5
	17-25	Very cobbly loam, very gravelly loam.	GM, SM	A-2, A-4	---	10-30	55-75	50-65	40-55	25-40	30-40	NP-5
	25-36	Extremely gravelly loam, very gravelly silt loam, extremely cobbly loam.	GM	A-1, A-2	---	15-55	30-60	20-50	15-40	15-35	30-40	NP-5
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
209*: Reggad-----	0-8	Very cobbly muck.	PT	A-8	---	50-75	---	---	---	---	---	---
	8-17	Very cobbly sapric material.	PT	A-8	---	50-70	---	---	---	---	---	NP
	17-60	Fragmental material.	GP	A-1	---	80-85	25-40	0-5	0-5	---	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
209*: Klapatche----	0-8	Loamy sand----	SM	A-1, A-2	---	0-5	80-100	80-95	40-60	15-25	---	NP
	8-12	Very gravelly sandy loam, gravelly silt loam, very gravelly loamy sand.	SM, GM	A-1, A-2, A-4	---	0-10	60-80	40-75	35-60	10-50	15-20	NP-5
	12-20	Gravelly sandy loam, extremely gravelly sand, very gravelly loamy sand.	SM, GM, SP-SM, GP-GM	A-1	---	0-15	35-80	30-70	15-35	5-15	---	NP
	20-31	Extremely cobblely sand, very cobblely sand, extremely gravelly sand.	GP, SP	A-1	---	25-50	35-60	30-55	10-25	0-5	---	NP
	31-38	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
210*: Reggad-----	0-8	Very cobblely muck.	PT	A-8	---	50-75	---	---	---	---	---	---
	8-17	Very cobblely sapric material.	PT	A-8	---	50-70	---	---	---	---	---	NP
	17-60	Fragmental material.	GP	A-1	---	80-85	25-40	0-5	0-5	---	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
210*: Serene-----	0-6	Gravelly sandy loam.	SM	A-1, A-2	---	0-5	65-90	55-75	40-55	20-30	15-25	NP-5
	6-14	Gravelly sandy loam, very gravelly loamy sand, very gravelly sandy loam.	GM, SM	A-1	---	0-10	50-70	30-55	20-35	10-20	15-25	NP-5
	14-30	Extremely cobbly coarse sand, extremely cobbly loamy sand, very gravelly sand.	SP, SP-SM	A-1	---	45-70	50-70	35-60	15-25	0-10	---	NP
	30	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
211, 212----- Reichel	0-10	Silt loam-----	ML, MH, OL, OH	A-5, A-7	0	0	95-100	85-100	80-95	75-90	40-60	5-20
	10-18	Loam, silt loam.	ML, MH	A-5, A-7	---	0-5	90-100	75-95	60-90	50-85	40-60	5-20
	18-28	Gravelly clay loam, gravelly loam, silty clay loam.	ML, SM, MH	A-7	---	0-10	80-95	60-90	55-85	40-65	40-60	10-25
	28-47	Very cobbly loam, very gravelly loam, very gravelly clay loam.	GM	A-5, A-2, A-7	---	10-45	50-60	40-55	35-50	25-45	40-60	5-20
	47	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
213, 214----- Reichel	0-14	Silt loam-----	ML, MH	A-5, A-7	0	0	90-100	85-100	75-95	55-75	40-60	5-20
	14-45	Clay loam, loam, gravelly loam.	ML, SM, MH	A-5, A-7	---	0-10	80-95	60-90	55-85	40-70	40-60	5-20
	45-60	Very cobbly loam, very gravelly loam, very gravelly clay loam.	GM	A-5, A-2, A-7	---	10-45	50-60	40-55	35-50	25-45	40-60	5-20
215*----- Riverwash	0-60	Variable-----	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
216, 217----- Rober	0-6	Loam-----	ML	A-4, A-5	0	0	100	100	90-100	50-75	35-45	5-10
	6-30	Silt loam, loam.	ML	A-4, A-5	0	0	95-100	90-100	85-100	75-90	35-45	5-10
	30-60	Silt loam, silty clay loam.	ML	A-4, A-6	0	0	95-100	95-100	90-100	75-95	30-40	5-15
218*----- Rock outcrop	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
219*: Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Cattcreek----	0-7	Very cindery loamy sand.	SM, SP-SM	A-1	0	0	75-90	25-50	15-30	5-15	---	NP
	7-11	Very cindery sand, very cindery loamy sand.	SP-SM, SP	A-1	0	0	75-90	25-50	15-35	0-10	---	NP
	11-21	Extremely cindery sand, very cindery sand.	SP	A-1	0	0	70-90	10-35	5-20	0-5	---	NP
	21-60	Very gravelly sandy loam, extremely gravelly loam.	GM, GP-GM	A-1, A-2	---	10-35	20-35	10-35	10-20	5-20	25-45	NP-10
220*: Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Cayuse-----	0-13	Sandy loam----	SM	A-2, A-4	0	0	85-100	80-100	40-60	30-50	25-30	NP-5
	13-30	Loam, sandy loam.	SM, ML	A-2, A-4	0	0	85-100	75-100	40-80	30-60	25-35	NP-5
	30-36	Gravelly loam, gravelly sandy loam.	SM	A-2, A-4	---	0-10	70-85	55-75	40-55	25-40	30-40	NP-10
	36-60	Very gravelly loam, gravelly loam, very gravelly sandy loam.	SM, GM	A-1, A-2	---	0-10	50-70	35-55	25-45	15-35	30-40	NP-10
221*: Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
221*: Haywire-----	0-4	Sandy loam----	SM	A-2, A-4	0	0	90-100	85-100	50-65	25-40	15-25	NP-5
	4-17	Loam, gravelly sandy loam, gravelly loam.	SM	A-1, A-2, A-4	---	0-10	75-95	60-90	40-80	20-50	25-35	NP-5
	17-25	Very cobbly loam, very gravelly loam.	GM, SM	A-2, A-4	---	10-30	55-75	50-65	40-55	25-40	30-40	NP-5
	25-36	Extremely gravelly loam, very gravelly silt loam, extremely cobbly loam.	GM	A-1, A-2	---	15-55	30-60	20-50	15-40	15-35	30-40	NP-5
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
222*: Rock outcrop--	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rubble land--	0-60	Fragmental material.	GP	A-1	---	75-90	0-10	0-5	0-5	0	---	NP
Haywire-----	0-4	Sandy loam----	SM	A-2, A-4	0	0	90-100	85-100	50-65	25-40	15-25	NP-5
	4-17	Loam, gravelly sandy loam, gravelly loam.	SM	A-1, A-2, A-4	---	0-10	75-95	60-90	40-80	20-50	25-35	NP-5
	17-25	Very cobbly loam, very gravelly loam.	GM, SM	A-2, A-4	---	10-30	55-75	50-65	40-55	25-40	30-40	NP-5
	25-36	Extremely gravelly loam, very gravelly silt loam, extremely cobbly loam.	GM	A-1, A-2	---	15-55	30-60	20-50	15-40	15-35	30-40	NP-5
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
223*: Rock outcrop--	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rubble land--	0-60	Fragmental material.	GP	A-1	---	75-90	0-10	0-5	0-5	0	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
223*: Serene-----	0-6	Gravelly sandy loam.	SM	A-1, A-2	---	0-5	65-90	55-75	40-55	20-30	15-25	NP-5
	6-14	Gravelly sandy loam, very gravelly loamy sand, very gravelly sandy loam.	GM, SM	A-1	---	0-10	50-70	30-55	20-35	10-20	15-25	NP-5
	14-30	Extremely cobbly coarse sand, extremely cobbly loamy sand, very gravelly sand.	SP, SP-SM	A-1	---	45-70	50-70	35-60	15-25	0-10	---	NP
	30	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
224*----- Rubble land	0-60	Fragmental material.	GP	A-1	---	75-90	0-10	0-5	0-5	0	---	NP
225----- Rugles	0-11	Silt loam-----	CL-ML	A-4	0	0	95-100	90-100	85-95	75-90	20-25	5-10
	11-57	Silt loam, silty clay loam.	CL	A-6	---	0-5	95-100	85-100	80-95	70-90	25-35	10-15
	57-60	Silty clay loam.	CL	A-6, A-7	---	0-5	95-100	85-100	80-95	70-90	30-45	10-20
226----- Salal	0-11	Silt loam-----	CL-ML	A-4	0	0	100	100	90-100	80-95	20-25	5-10
	11-50	Silt loam, very fine sandy loam.	CL-ML	A-4	0	0	100	100	90-100	80-90	20-25	5-10
	50-60	Silt loam, very fine sandy loam.	CL-ML	A-4	0	0	100	85-100	80-95	75-90	20-25	5-10
227----- Sauk	0-6	Silt loam-----	ML	A-4, A-5	0	0	90-100	85-100	80-95	70-85	35-45	NP-10
	6-22	Silt loam, very fine sandy loam, fine sandy loam.	ML	A-4, A-5	0	0	90-100	85-100	80-95	60-85	35-45	NP-10
	22-42	Silt loam, very fine sandy loam, fine sandy loam.	ML	A-4	0	0	90-100	85-100	80-95	60-85	15-25	NP-5
	42-60	Very gravelly loamy sand, very gravelly sandy loam, very gravelly sand.	GM, SM, GP, SP	A-1	---	0-10	45-70	40-55	20-45	0-15	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
228, 229, 230- Scamman	0-6	Silt loam-----	CL	A-6	0	0-5	90-100	85-95	80-90	75-85	30-40	10-15
	6-14	Silty clay loam, silt loam.	CL	A-6, A-7	0	0-5	90-100	85-95	80-90	75-85	30-45	15-25
	14-27	Silty clay loam, silty clay.	CL, CH	A-7	0	0-5	90-100	85-95	80-90	75-85	45-55	20-30
	27-60	Silty clay, clay.	CH	A-7	0-5	0-15	75-90	75-85	70-85	70-80	50-70	25-40
231----- Seattle	0-8	Muck-----	PT	A-8	0	0	---	---	---	---	---	---
	8-60	Stratified sapric material to hemic material.	PT	A-8	0	0	---	---	---	---	---	---
232, 233----- Serene	0-6	Gravelly sandy loam.	SM	A-1, A-2	---	0-5	65-90	55-75	40-55	20-30	15-25	NP-5
	6-14	Gravelly sandy loam, very gravelly loamy sand, very gravelly sandy loam.	GM, SM	A-1	---	0-10	50-70	30-55	20-35	10-20	15-25	NP-5
	14-30	Extremely cobble coarse sand, extremely cobble loamy sand, very gravelly sand.	SP, SP-SM	A-1	---	45-70	50-70	35-60	15-25	0-10	---	NP
	30	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
234*: Serene-----	0-6	Gravelly sandy loam.	SM	A-1, A-2	---	0-5	65-90	55-75	40-55	20-30	15-25	NP-5
	6-14	Gravelly sandy loam, very gravelly loamy sand, very gravelly sandy loam.	GM, SM	A-1	---	0-10	50-70	30-55	20-35	10-20	15-25	NP-5
	14-30	Extremely cobble coarse sand, extremely cobble loamy sand, very gravelly sand.	SP, SP-SM	A-1	---	45-70	50-70	35-60	15-25	0-10	---	NP
	30	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
Rock outcrop-	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
235----- Shalcar	0-10	Muck-----	PT	A-8	0	0	---	---	---	---	---	---
	10-20	Sapric	PT	A-8	0	0	---	---	---	---	---	---
	20-60	material. Silt loam, silty clay loam, sandy loam.	ML, CL	A-4, A-6, A-7	0	0	100	100	80-100	50-90	25-45	NP-20
236----- Si	0-11	Silt loam----	ML	A-4	0	0	100	100	90-100	75-90	15-25	NP-5
	11-22	Silt loam----	ML	A-4	0	0	100	100	90-100	75-90	15-25	NP-5
	22-60	Stratified silt loam to fine sandy loam.	ML, SM	A-4	0	0	100	90-100	75-90	45-80	15-20	NP-5
237, 238----- Skykomish	0-10	Gravelly sandy loam.	SM	A-1, A-2	---	0-10	65-85	50-75	20-35	15-30	40-50	NP-5
	10-15	Very gravelly sandy loam, very gravelly fine sandy loam, very gravelly loam.	GM	A-1, A-2	---	5-10	40-55	35-50	20-45	10-30	30-40	NP-5
	15-60	Extremely gravelly coarse sand, extremely gravelly loamy sand, very gravelly loamy sand.	GP, GP-GM	A-1	---	5-30	25-50	10-40	5-25	0-10	---	NP
239----- Skykomish	0-10	Gravelly sandy loam.	SM	A-1, A-2	---	0-10	65-85	50-75	20-35	15-30	40-50	NP-5
	10-15	Very gravelly sandy loam, very gravelly fine sandy loam, very gravelly loam.	GM	A-1, A-2	---	5-10	40-55	35-50	20-45	10-30	30-40	NP-5
	15-60	Extremely gravelly coarse sand, extremely gravelly loamy sand, very gravelly loamy sand.	GP, GP-GM	A-1	---	5-30	25-50	10-40	5-25	0-10	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
240----- Skykomish	0-5	Very stony loam.	SM, GM	A-2, A-5	---	25-40	60-85	45-75	35-55	25-40	40-50	NP-5
	5-22	Very stony loam, very stony sandy loam.	SM, GM	A-4, A-2, A-1	---	35-50	55-85	40-75	30-65	20-45	30-40	NP-5
	22-60	Very stony sand, extremely stony sand, extremely stony loamy sand.	GM, GP-GM, GP, SM	A-1	---	35-50	30-65	15-55	10-35	0-15	---	NP
241----- Snoqualmie	0-8	Loamy fine sand.	SM	A-2	0	0	85-100	75-100	60-80	15-30	---	NP
	8-36	Extremely gravelly coarse sand, extremely cobbly fine sand, very gravelly loamy fine sand.	GP, SP	A-1	---	20-55	40-55	30-50	10-30	0-5	---	NP
	36-60	Extremely cobbly coarse sand, extremely gravelly coarse sand, very gravelly sand.	GP, SP	A-1	---	20-55	35-55	25-45	10-20	0-5	---	NP
242----- Snoqualmie	0-8	Loamy fine sand.	SM	A-2	0	0	85-100	75-100	60-80	15-30	---	NP
	8-36	Extremely gravelly coarse sand, extremely cobbly fine sand, very gravelly loamy fine sand.	GP, SP	A-1	---	20-55	40-55	30-50	10-30	0-5	---	NP
	36-60	Extremely cobbly coarse sand, extremely gravelly coarse sand, very gravelly sand.	GP, SP	A-1	---	20-55	35-55	25-45	10-20	0-5	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
243----- Spukwush	0-7	Loamy sand----	SM	A-1, A-2	---	0-5	95-100	80-90	45-65	15-25	---	NP
	7-15	Cindery sandy loam, very cindery sandy loam.	SM	A-1	---	0-5	65-90	45-75	30-45	15-20	20-25	NP-5
	15-36	Loam-----	CL	A-6	---	0-5	90-100	75-90	70-85	50-65	30-35	10-15
	36-60	Gravelly loam, loam.	CL, SC	A-6	---	0-5	85-95	60-90	55-85	45-65	30-35	10-15
244----- Stahl	0-8	Very gravelly silt loam.	GM, SM	A-2	0	0	50-70	30-50	25-45	20-35	40-60	5-20
	8-15	Extremely gravelly silt loam, very gravelly silty clay loam, very gravelly silt loam.	GM	A-2	---	10-25	40-60	15-40	15-40	10-35	40-60	5-20
	15-29	Extremely cobbly silty clay loam, extremely cobbly silt loam, extremely gravelly silt loam.	GM	A-2	---	30-55	40-60	15-35	15-30	10-30	40-60	5-20
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
245----- Stahl	0-7	Very gravelly silt loam.	GM, SM	A-2	0	0	50-70	30-50	25-45	20-35	40-60	5-20
	7-17	Extremely gravelly silt loam, very gravelly silty clay loam, very gravelly silt loam.	GM	A-2	---	10-25	40-60	15-40	15-40	10-35	40-60	5-20
	17-35	Extremely cobbly silty clay loam, extremely cobbly silt loam, extremely gravelly silt loam.	GM	A-2	---	30-55	40-60	15-35	15-30	10-30	40-60	5-20
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
246----- Stahl	0-7	Very gravelly silt loam.	GM, SM	A-2	0	0	50-70	30-50	25-45	20-35	40-60	5-20
	7-17	Extremely gravelly silt loam, very gravelly silty clay loam, very gravelly silt loam.	GM	A-2	---	10-25	40-60	15-40	15-40	10-35	40-60	5-20
	17-35	Extremely cobblely silty clay loam, extremely cobblely silt loam, extremely gravelly silt loam.	GM	A-2	---	30-55	40-60	15-35	15-30	10-30	40-60	5-20
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
247----- Sulsavar	0-28	Loam-----	ML, SM	A-4	0	0	85-100	75-95	60-75	40-60	20-30	NP-5
	28-51	Gravelly sandy loam, sandy loam, loam.	SM, ML	A-1, A-2, A-4	---	0-5	65-85	55-85	35-65	20-55	20-30	NP-5
	51-60	Very gravelly loamy sand, loam, very gravelly loam.	GM, SM	A-1, A-2, A-4	---	0-5	35-80	30-75	15-65	10-40	20-25	NP-5
248----- Sultan	0-9	Silt loam----	ML	A-4	0	0	100	100	80-90	70-80	20-30	NP-5
	9-48	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	80-90	25-35	5-15
	48-60	Stratified silt loam to sand.	SM	A-4, A-2	0	0	100	100	80-95	30-50	15-20	NP-5
249, 250, 251- Teneriffe	0-7	Loamy sand----	SM	A-1, A-2	0	0	90-100	80-95	45-65	20-30	---	NP
	7-11	Loamy sand, gravelly loamy sand.	SM	A-1, A-2	0	0	65-90	55-85	40-60	15-25	---	NP
	11-21	Very gravelly loamy sand, gravelly loamy sand.	SM, GM	A-1	---	0-10	55-70	45-60	30-40	15-20	---	NP
	21-37	Very gravelly loamy sand.	SM, GM	A-1	---	0-20	50-70	30-50	20-35	10-15	---	NP
	37-60	Very gravelly coarse sand, very gravelly loamy sand, extremely gravelly sand.	SP, GP, GP-GM, SP-SM	A-1	---	0-20	35-60	20-35	5-20	0-10	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct						
252, 253----- Teneriffe	0-6	Very gravelly sandy loam.	GM	A-1	---	0-10	40-60	30-50	15-35	10-25	20-30	NP-5
	6-11	Very gravelly loamy sand, gravelly loamy sand.	SM, GM	A-1	---	0-10	55-70	45-60	30-40	10-15	---	NP
	11-47	Very channery loamy sand, extremely channery loamy sand.	GP-GM, SP-SM	A-1	---	0-20	40-70	20-50	15-35	5-10	---	NP
	47	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
254, 255, 256, 257----- Tokul	0-3	Gravelly loam	SM, GM	A-4	---	0-5	60-80	55-75	50-65	35-45	30-40	NP-5
	3-31	Gravelly loam, gravelly silt loam, gravelly fine sandy loam.	SM, GM	A-2, A-4	---	0-15	60-80	60-75	40-65	25-50	30-40	NP-5
	31-37	Gravelly fine sandy loam, gravelly loam.	SM, GM	A-1, A-2, A-4	---	0-5	55-80	50-75	35-60	20-40	30-40	NP-5
	37	Cemented material.	---	---	---	---	---	---	---	---	---	---
258*: Tokul-----	0-3	Gravelly loam	SM, GM	A-4	---	0-5	60-80	55-75	50-65	35-45	30-40	NP-5
	3-31	Gravelly loam, gravelly silt loam, gravelly fine sandy loam.	SM, GM	A-2, A-4	---	0-15	60-80	60-75	40-65	25-50	30-40	NP-5
	31-37	Gravelly fine sandy loam, gravelly loam.	SM, GM	A-1, A-2, A-4	---	0-5	55-80	50-75	35-60	20-40	30-40	NP-5
	37	Cemented material.	---	---	---	---	---	---	---	---	---	---
Pastik-----	0-6	Silt loam-----	ML	A-4, A-5	0	0	100	100	85-100	75-90	35-45	5-10
	6-31	Silt loam, loam, very fine sandy loam.	ML	A-4, A-5	0	0	100	100	85-100	70-80	35-45	5-10
	31-60	Silt loam, silty clay loam.	ML	A-4, A-6	0	0	100	100	80-90	70-90	30-40	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
259*: Tokul-----	0-3	Gravelly loam	SM, GM	A-4	---	0-5	60-80	55-75	50-65	35-45	30-40	NP-5
	3-31	Gravelly loam, gravelly silt loam, gravelly fine sandy loam.	SM, GM	A-2, A-4	---	0-15	60-80	60-75	40-65	25-50	30-40	NP-5
	31-37	Gravelly fine sandy loam, gravelly loam.	SM, GM	A-1, A-2, A-4	---	0-5	55-80	50-75	35-60	20-40	30-40	NP-5
	37	Cemented material.	---	---	---	---	---	---	---	---	---	---
Pastik-----	0-6	Silt loam-----	ML	A-4, A-5	0	0	100	100	85-100	75-90	35-45	5-10
	6-31	Silt loam, loam, very fine sandy loam.	ML	A-4, A-5	0	0	100	100	85-100	70-80	35-45	5-10
	31-60	Silt loam, silty clay loam, very fine sandy loam.	ML	A-4, A-6	0	0	100	100	80-90	70-90	30-40	5-15
260----- Treen	0-5	Loam-----	CL-ML	A-4	0	0	95-100	80-90	70-85	50-65	20-30	5-10
	5-14	Sandy loam, gravelly sandy loam, loam.	SC-SM, CL-ML	A-2, A-4	0	0	90-100	65-90	40-80	30-60	15-25	5-10
	14-18	Gravelly sandy loam, loam, gravelly fine sandy loam.	SM	A-2, A-1	0	0-10	70-90	55-80	40-55	20-30	15-20	NP-5
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
261----- Tukwila	0-41	Muck-----	PT	A-8	0	0	---	---	---	---	---	---
	41-60	Stratified diatomaceous earth to sapric material.	PT	A-8	0	0	---	---	---	---	---	---
262, 263----- Tusip	0-6	Sandy loam----	SM	A-2, A-4	0	0	90-100	85-95	50-65	25-40	15-25	NP-5
	6-15	Sandy loam, loamy sand.	SM	A-2	0	0	90-100	80-95	50-65	15-30	---	NP
	15-38	Gravelly sandy loam, gravelly fine sandy loam.	SM	A-2, A-1	0	0	70-85	55-75	40-55	20-35	30-40	NP-10
	38-43	Very gravelly sandy loam, very gravelly fine sandy loam, gravelly sandy loam.	SM, GM	A-2, A-1	0	0	50-70	40-60	25-45	15-30	30-40	NP-10
	43	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
264----- Typic Haplorthods	0-3	Very gravelly loam.	GM	A-1, A-2	---	0-5	50-60	30-50	25-40	20-30	30-40	NP-10
	3-45	Very gravelly loam, very gravelly sandy loam.	GM	A-1	---	0-5	50-60	30-50	20-30	10-25	30-40	NP-10
	45	Cemented material.	---	---	---	---	---	---	---	---	---	---
265, 266----- Typic Udifuvents	0-5	Silt loam-----	ML	A-4, A-6	0	0	100	100	90-100	80-90	25-40	NP-15
	5-16	Silt loam, fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-6	0	0	95-100	85-100	70-100	40-90	15-40	NP-15
	16-60	Stratified fine sandy loam to gravelly coarse sand.	SM	A-1, A-2, A-4	---	0-5	75-100	65-95	35-70	10-40	---	NP
267----- Udifuvents	0-6	Gravelly sandy loam.	SM	A-2, A-1	---	5-15	75-90	60-80	35-50	20-35	15-20	NP-5
	6-21	Gravelly loamy sand, very gravelly loamy sand, gravelly sand.	GP, GP-GM, SP, SP-SM	A-1	---	5-15	30-65	20-50	10-30	0-15	---	NP
	21-60	Stratified sandy clay loam to extremely gravelly sandy loam.	GM, SC-SM, SM, GM-GC	A-1, A-2	---	5-30	40-75	25-50	20-40	10-25	15-25	NP-10
268, 269----- Vailton	0-10	Silt loam-----	ML, MH	A-5, A-7	0	0	100	100	90-100	70-90	45-65	5-20
	10-37	Silty clay loam, silt loam.	ML, MH	A-5, A-7	0	0	100	100	85-100	75-95	40-60	5-20
	37-43	Silty clay loam, clay loam.	ML, MH	A-7, A-5	0	0	100	100	90-100	70-95	40-60	5-20
	43	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
270, 271, 272- Voight	0-11	Silt loam-----	CL-ML, ML	A-4	---	0-5	90-100	75-100	70-100	55-90	25-35	5-10
	11-43	Gravelly silty clay loam, silty clay loam, clay loam.	CL, SC, SM, MH	A-7	---	0-10	70-95	60-90	50-85	40-80	40-60	15-25
	43-58	Gravelly loam, silty clay loam, gravelly silt loam.	CL, SC, GC	A-6, A-7	---	0-10	70-95	60-90	50-85	40-80	30-45	10-20
	58-60	Gravelly loam, silt loam, gravelly silt loam.	CL-ML, GM-GC, CL, SC-SM	A-4, A-6	---	0-10	65-95	50-90	45-80	35-70	25-35	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
273, 274----- Welcome	0-5	Loam-----	SM, ML	A-4	0	0	95-100	90-100	65-90	45-75	25-35	NP-5
	5-35	Loam, silt loam, gravelly loam.	SM, ML	A-4	0	0	80-100	70-100	60-90	45-80	25-35	NP-5
	35-53	Sandy loam, fine sandy loam, gravelly sandy loam.	SM	A-2	---	0-5	75-100	65-100	45-75	25-35	20-30	NP-5
	53	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
275, 276, 277- Wilkeson	0-8	Gravelly silt loam.	CL-ML, ML	A-4	---	0-5	70-80	60-75	60-75	50-65	20-30	NP-10
	8-16	Gravelly silt loam, gravelly loam, loam.	CL-ML, CL	A-4, A-6	---	0-10	80-95	65-90	65-90	55-85	25-35	5-15
	16-34	Gravelly loam, loam, gravelly silty clay loam.	CL, GC, SC	A-6	---	0-5	70-95	60-90	50-85	45-65	30-40	10-20
	34-60	Gravelly loam, loam, gravelly clay loam.	CL-ML, CL, GC, GM-GC	A-4, A-6	---	0-5	65-85	55-80	50-70	40-60	25-40	5-20
278, 279, 280- Winston	0-11	Loam-----	ML, MH	A-4, A-5, A-7	0	0	95-100	85-95	75-85	55-80	35-60	NP-20
	11-21	Loam, gravelly loam, gravelly fine sandy loam.	ML, GM, SM, MH	A-4, A-2, A-5, A-7	---	0-5	60-95	55-90	40-80	25-60	30-60	NP-20
	21-34	Gravelly silt loam, loam, gravelly fine sandy loam.	ML, GM, SM, MH	A-4, A-2, A-5, A-7	---	0-5	60-95	55-90	40-80	25-60	30-60	NP-20
	34-60	Very gravelly sand, extremely gravelly coarse sand, extremely gravelly sand.	GP	A-1	---	5-15	10-40	5-35	5-20	0-5	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments	Frag- ments	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	> 10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
281----- Woodinville	0-7	Silt loam-----	ML	A-4	0	0	100	100	80-95	75-90	30-40	5-10
	7-15	Silt loam, silty clay loam.	ML	A-4	0	0	100	100	85-100	80-95	30-40	5-10
	15-60	Stratified silt loam to sapric material.	ML, PT, OL	A-4, A-8, A-5	0	0	100	100	85-100	80-95	35-45	5-10
282, 283----- Zynbar	0-18	Loam-----	ML, MH	A-5, A-7	---	0-5	85-100	75-95	60-70	50-60	45-70	5-20
	18-41	Gravelly silt loam, gravelly loam.	ML, MH	A-5, A-7	---	0-5	75-95	55-75	55-75	50-75	45-70	5-20
	41-60	Silt loam, loam.	ML, MH	A-5, A-7	---	0-5	90-100	70-95	60-90	50-80	45-70	5-20
284----- Zynbar	0-9	Silt loam-----	ML, MH	A-4, A-5, A-7	---	0-5	85-95	75-90	60-85	50-80	35-60	NP-20
	9-29	Silt loam, gravelly silt loam.	ML, SM, MH	A-4, A-5, A-7, A-6	---	0-5	75-95	60-90	55-85	45-80	35-60	5-25
	29-60	Very gravelly silt loam, very gravelly loam, extremely stony silt loam.	GM	A-2, A-4, A-5, A-7	---	15-55	50-65	30-60	30-55	25-45	35-60	NP-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
1, 2----- Alderwood	0-6 6-33 33	5-10 5-10 ---	1.15-1.35 1.25-1.45 ---	0.6-2.0 2.0-6.0 ---	0.19-0.21 0.06-0.10 ---	5.1-6.5 5.1-6.5 ---	Low----- Low----- -----	0.32 0.10 ---	2	3-10
3----- Alkiridge	0-7 7-18 18-37 37	5-10 5-10 5-15 ---	0.65-0.95 0.65-1.10 0.85-1.20 ---	2.0-6.0 2.0-6.0 0.6-2.0 ---	0.12-0.15 0.09-0.12 0.10-0.15 ---	5.1-6.0 5.1-6.0 5.6-6.5 ---	Low----- Low----- Low----- -----	0.24 0.10 0.10 ---	2	5-10
4, 5, 6----- Altapeak	0-6 6-16 16-24 24-50 50	--- --- --- --- ---	0.75-1.10 0.85-1.15 0.85-1.20 0.95-1.40 ---	2.0-6.0 2.0-6.0 2.0-6.0 6.0-20 ---	0.08-0.11 0.07-0.10 0.03-0.07 0.02-0.04 ---	4.5-5.5 5.1-6.5 5.1-6.5 5.1-6.5 ---	Low----- Low----- Low----- Low----- -----	0.15 0.10 0.05 0.02 ---	3	5-10
7*: Altapeak-----	0-6 6-16 16-24 24-50 50	--- --- --- --- ---	0.75-1.10 0.85-1.15 0.85-1.20 0.95-1.40 ---	2.0-6.0 2.0-6.0 2.0-6.0 6.0-20 ---	0.08-0.11 0.07-0.10 0.03-0.07 0.02-0.04 ---	4.5-5.5 5.1-6.5 5.1-6.5 5.1-6.5 ---	Low----- Low----- Low----- Low----- -----	0.15 0.10 0.05 0.02 ---	3	5-10
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
8----- Andic Cryumbrepts	0-5 5-16 16-44 44	--- 5-10 5-10 ---	0.65-0.95 0.65-1.15 0.85-1.20 ---	2.0-6.0 2.0-6.0 2.0-6.0 ---	0.12-0.14 0.08-0.12 0.03-0.07 ---	5.1-5.5 5.1-5.5 5.1-5.5 ---	Low----- Low----- Low----- -----	0.10 0.10 0.05 ---	2	2-8
9----- Arents	0-35 35-60	10-15 0-5	0.85-1.40 1.30-1.70	2.0-6.0 2.0-20	0.11-0.15 0.02-0.05	5.6-6.5 5.6-6.5	Low----- Low-----	0.20 0.02	5	0-2
10, 11, 12----- Barneston	0-9 9-14 14-60	--- --- 0-3	0.85-1.15 0.90-1.20 1.50-1.70	2.0-6.0 2.0-6.0 >20	0.15-0.20 0.10-0.15 0.03-0.05	5.1-6.0 5.1-6.0 5.1-6.0	Low----- Low----- Low-----	0.15 0.10 0.05	1	2-8
13, 14, 15, 16--- Barneston	0-9 9-17 17-60	--- --- 0-3	0.85-1.15 0.90-1.20 1.50-1.70	2.0-6.0 2.0-6.0 >20	0.15-0.20 0.10-0.15 0.03-0.05	5.1-6.0 5.1-6.0 5.1-6.0	Low----- Low----- Low-----	0.15 0.10 0.05	1	2-8
17, 18, 19----- Beausite	0-5 5-11 11-36 36	10-18 5-15 5-15 ---	1.15-1.35 1.35-1.55 1.35-1.55 ---	0.6-2.0 0.6-2.0 0.6-2.0 ---	0.12-0.15 0.07-0.12 0.05-0.10 ---	5.6-6.0 5.6-6.5 5.6-6.5 ---	Low----- Low----- Low----- -----	0.20 0.05 0.05 ---	2	2-8
20----- Belfast	0-7 7-38 38-60	5-15 5-15 5-15	1.15-1.35 1.30-1.50 1.30-1.50	0.6-2.0 0.6-2.0 0.6-2.0	0.22-0.24 0.19-0.21 0.18-0.20	5.6-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low-----	0.32 0.37 0.43	5	5-10
21, 22----- Bellicum	0-6 6-21 21-39 39-52 52	--- --- --- --- ---	0.65-0.85 0.65-0.85 0.65-0.85 0.65-0.85 ---	6.0-20 >20 0.6-2.0 0.6-2.0 ---	0.08-0.12 0.07-0.11 0.10-0.15 0.05-0.10 ---	5.1-6.5 5.1-6.5 5.1-6.5 5.1-6.5 ---	Low----- Low----- Low----- Low----- -----	0.05 0.05 0.10 0.05 ---	3	5-10

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction pH	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
23, 24----- Blethen	0-5 5-24 24-42 42-60	7-15 5-10 5-10 5-10	0.90-1.10 1.00-1.20 1.00-1.20 1.10-1.30	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0	0.15-0.20 0.10-0.15 0.10-0.15 0.10-0.15	5.1-6.5 5.1-6.5 5.1-6.5 5.1-6.5	Low----- Low----- Low----- Low-----	0.24 0.15 0.10 0.10	5	3-9
25----- Borochemists	0-4 4-30 30-60	--- --- ---	--- --- ---	0.6-2.0 0.6-2.0 ---	0.30-0.40 0.30-0.40 ---	4.5-6.0 4.5-6.0 ---	Low----- Low----- ---	0.02 0.02 ---	5	40-80
26----- Bromo	0-4 4-32 32-60	--- --- ---	0.60-0.90 0.60-0.90 0.85-1.30	2.0-6.0 >20 0.6-2.0	0.11-0.15 0.06-0.10 0.13-0.25	5.1-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low-----	0.10 0.02 0.28	5	4-10
27, 28----- Cattcreek	0-7 7-11 11-21 21-60	--- --- --- ---	0.60-0.85 0.65-0.90 0.65-1.00 0.75-1.20	6.0-20 6.0-20 >20 0.6-2.0	0.08-0.12 0.07-0.11 0.06-0.10 0.05-0.10	5.6-6.5 5.6-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low----- Low-----	0.10 0.05 0.02 0.05	3	3-8
29, 30----- Cattcreek	0-7 7-31 31-60	--- --- ---	0.60-0.85 0.65-0.90 0.75-1.20	6.0-20 >20 2.0-6.0	0.05-0.10 0.03-0.08 0.05-0.10	5.6-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low-----	0.10 0.05 0.05	3	3-8
31----- Cattcreek	0-8 8-17 17-50 50	--- --- --- ---	0.60-0.85 0.65-0.90 1.30-1.60 ---	6.0-20 6.0-20 0.6-2.0 ---	0.07-0.11 0.06-0.11 0.03-0.07 ---	5.6-6.5 5.6-6.5 5.6-6.5 ---	Low----- Low----- Low----- ---	0.05 0.02 0.05 ---	4	3-8
32, 33----- Cayuse	0-13 13-30 30-36 36-60	--- --- --- ---	0.60-0.85 0.65-0.85 0.70-1.10 0.85-1.30	2.0-6.0 0.6-2.0 0.6-2.0 0.6-2.0	0.10-0.13 0.10-0.15 0.09-0.13 0.06-0.10	4.5-6.0 4.5-6.0 4.5-6.0 4.5-6.0	Low----- Low----- Low----- Low-----	0.24 0.24 0.20 0.10	5	3-8
34, 35, 36, 37, 38----- Chinkmin	0-8 8-15 15-22 22-32 32	5-15 5-15 5-15 5-15 ---	0.60-0.85 0.60-1.10 0.60-1.10 0.60-1.10 ---	2.0-6.0 0.6-2.0 0.6-2.0 0.6-2.0 ---	0.10-0.12 0.11-0.14 0.06-0.10 0.06-0.10 ---	4.5-5.5 5.1-5.5 5.1-5.5 5.1-5.5 ---	Low----- Low----- Low----- Low----- ---	0.20 0.20 0.10 0.10 ---	2	10-15
39, 40----- Christoff	0-12 12-26 26-60	--- 10-20 25-35	0.85-1.10 0.95-1.30 0.95-1.35	6.0-20 0.6-2.0 0.2-0.6	0.08-0.10 0.14-0.17 0.16-0.18	5.1-6.0 5.6-6.0 5.6-6.0	Low----- Moderate---- Moderate----	0.20 0.37 0.32	5	4-10
41, 42, 43----- Chuckanut	0-8 8-35 35-50 50	7-15 5-15 5-15 ---	0.85-1.10 0.95-1.20 1.10-1.30 ---	0.6-2.0 0.6-2.0 0.6-2.0 ---	0.20-0.25 0.12-0.20 0.10-0.15 ---	5.1-6.0 5.1-6.0 5.1-6.0 ---	Low----- Low----- Low----- ---	0.32 0.20 0.20 ---	3	2-8
44, 45, 46----- Cinebar	0-10 10-54 54-60	--- --- ---	0.65-0.85 0.65-0.85 0.65-1.00	0.6-2.0 0.6-2.0 0.6-2.0	0.30-0.40 0.25-0.35 0.20-0.30	4.5-7.3 5.1-6.5 5.1-7.3	Low----- Low----- Low-----	0.28 0.32 0.32	5	3-9
47----- Cotteral	0-9 9-32 32-60	--- --- ---	0.60-0.80 0.65-0.85 0.65-0.95	2.0-6.0 2.0-6.0 0.6-2.0	0.11-0.15 0.11-0.15 0.18-0.21	4.5-7.3 5.1-7.3 5.6-7.3	Low----- Low----- Low-----	0.10 0.05 0.32	5	3-8
48----- Cotteral	0-3 3-14 14-60	--- --- ---	0.60-0.80 0.65-0.85 0.65-0.95	2.0-6.0 2.0-6.0 0.6-2.0	0.11-0.15 0.11-0.15 0.18-0.21	4.5-7.3 5.1-7.3 5.6-7.3	Low----- Low----- Low-----	0.10 0.05 0.32	5	3-8

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
49----- Crinker	0-5 5-32 32	7-15 7-15 ---	0.90-1.15 1.00-1.20 ---	0.6-2.0 0.6-2.0 ---	0.15-0.20 0.10-0.18 ---	3.6-5.5 5.1-6.0 ---	Low----- Low----- -----	0.17 0.05 ---	2	5-10
50----- Cryofluvents	0-5 5-9 9-49 49	5-10 1-10 1-5 ---	0.85-1.20 0.95-1.50 1.00-1.70 ---	2.0-6.0 0.6-6.0 2.0-20 ---	0.08-0.11 0.08-0.14 0.03-0.05 ---	4.5-5.5 4.5-6.0 5.1-6.5 ---	Low----- Low----- Low----- -----	0.10 0.10 0.05 ---	5	.5-3
51----- Cryohemists	0-6 6-28 28-60	--- --- 10-30	--- --- ---	0.6-2.0 0.6-2.0 0.2-0.6	0.25-0.30 0.25-0.30 0.15-0.20	4.5-6.0 6.1-6.5 6.1-6.5	Low----- Low----- Low-----	0.00 0.00 0.32	5	30-60
52----- Dobbs	0-10 10-35 35	--- --- ---	0.65-0.90 0.85-1.10 ---	0.6-2.0 0.6-2.0 ---	0.17-0.25 0.10-0.15 ---	5.6-6.5 5.6-6.5 ---	Low----- Low----- -----	0.24 0.15 ---	2	4-15
53----- Edgewick	0-8 8-20 20-46 46-60	5-10 5-10 5-10 0-20	1.20-1.40 1.30-1.50 1.30-1.50 1.50-1.65	2.0-6.0 2.0-6.0 0.6-2.0 >20	0.16-0.19 0.10-0.14 0.07-0.13 0.02-0.05	4.5-6.0 5.6-6.5 6.1-7.3 6.1-7.3	Low----- Low----- Low----- Low-----	0.37 0.28 0.32 0.05	3	3-5
54, 55----- Elwell	0-8 8-35 35	5-18 5-18 ---	0.85-1.10 0.85-1.10 ---	0.6-2.0 0.6-2.0 ---	0.30-0.40 0.15-0.25 ---	3.6-5.5 5.1-5.5 ---	Low----- Low----- -----	0.28 0.20 ---	2	10-15
56, 57----- Ethanias	0-7 7-31 31-60	--- --- ---	0.60-0.85 0.60-0.95 0.60-1.00	6.0-20 >20 0.6-2.0	0.08-0.12 0.08-0.12 0.10-0.15	4.5-6.0 5.1-6.0 5.1-6.0	Low----- Low----- Low-----	0.10 0.10 0.10	5	10-15
58, 59----- Ethanias	0-6 6-14 14-36 36-60	--- --- --- ---	0.60-0.85 0.60-0.95 0.60-1.00 0.85-1.25	6.0-20 >20 0.6-2.0 2.0-6.0	0.08-0.12 0.08-0.12 0.10-0.15 0.05-0.10	4.5-6.0 5.1-6.0 5.1-6.0 5.1-6.0	Low----- Low----- Low----- Low-----	0.10 0.10 0.10 0.05	5	10-15
60----- Ethanias	0-8 8-15 15-41 41	--- --- --- ---	0.60-0.85 0.60-0.85 0.85-1.15 ---	6.0-20 >20 0.6-2.0 ---	0.08-0.12 0.08-0.12 0.10-0.15 ---	4.5-6.0 5.1-6.0 5.1-6.0 ---	Low----- Low----- Low----- -----	0.10 0.10 0.10 ---	3	10-15
61, 62----- Foss	0-4 4-16 16-60	--- --- ---	0.60-0.85 0.60-0.85 0.60-1.10	0.6-2.0 0.6-2.0 0.6-2.0	0.15-0.20 0.15-0.20 0.10-0.15	5.1-6.0 5.1-6.0 5.1-6.0	Low----- Low----- Low-----	0.10 0.24 0.15	5	10-15
63, 64----- Gallup	0-5 5-14 14-41 41-60	7-18 5-18 5-18 5-18	0.85-1.00 0.85-1.00 0.95-1.10 1.00-1.20	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0	0.20-0.25 0.15-0.20 0.10-0.15 0.10-0.15	3.6-5.5 3.6-5.5 3.6-5.5 3.6-5.5	Low----- Low----- Low----- Low-----	0.32 0.24 0.20 0.20	5	10-15
65----- Gallup	0-7 7-15 15-36 36-60	7-18 5-18 5-18 5-18	0.85-1.00 0.85-1.00 0.95-1.10 1.00-1.20	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0	0.20-0.25 0.15-0.20 0.10-0.15 0.10-0.15	3.6-5.5 3.6-5.5 3.6-5.5 3.6-5.5	Low----- Low----- Low----- Low-----	0.32 0.24 0.20 0.20	5	10-15
66, 67, 68----- Getchell	0-7 7-19 19-30 30	--- --- --- ---	0.60-1.00 0.60-1.00 0.60-1.00 ---	0.6-2.0 0.6-2.0 0.6-2.0 ---	0.25-0.35 0.20-0.30 0.18-0.25 ---	3.6-5.0 3.6-5.5 4.5-5.5 ---	Low----- Low----- Low----- -----	0.28 0.24 0.28 ---	2	10-15

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction pH	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
69----- Greenwater	0-5	0-5	1.25-1.45	6.0-20	0.06-0.08	5.1-6.5	Low-----	0.17	5	1-5
	5-17	0-5	1.40-1.60	6.0-20	0.06-0.08	5.1-6.5	Low-----	0.17		
	17-51	0-5	1.45-1.65	6.0-20	0.05-0.07	5.6-6.5	Low-----	0.10		
	51-60	0-5	1.45-1.65	>20	0.03-0.07	5.6-6.5	Low-----	0.05		
70----- Grotto	0-5	0-5	1.25-1.45	6.0-20	0.06-0.08	4.5-6.0	Low-----	0.10	5	.5-2
	5-19	0-5	1.35-1.55	6.0-20	0.06-0.09	4.5-5.5	Low-----	0.17		
	19-36	0-5	1.40-1.65	6.0-20	0.05-0.08	5.6-6.5	Low-----	0.15		
	36-60	0-2	1.45-1.65	>20	0.03-0.05	5.6-6.5	Low-----	0.02		
71----- Hartnit	0-6	---	0.60-1.00	0.6-2.0	0.25-0.35	3.6-6.0	Low-----	0.24	2	10-15
	6-20	---	0.60-1.00	0.6-2.0	0.15-0.25	4.5-6.0	Low-----	0.37		
	20-31	---	0.90-1.10	0.6-2.0	0.10-0.20	4.5-6.0	Low-----	0.24		
	31	---	---	---	---	---	-----	---		
72, 73----- Haywire	0-4	2-10	0.60-0.85	2.0-6.0	0.10-0.15	4.5-5.0	Low-----	0.20	2	10-15
	4-17	5-15	0.60-0.85	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.20		
	17-25	5-15	0.75-1.10	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.20		
	25-36	5-15	0.80-1.20	0.6-2.0	0.08-0.15	5.1-6.0	Low-----	0.10		
74, 75----- Haywire	0-8	2-5	0.60-0.85	2.0-6.0	0.05-0.10	4.5-5.0	Low-----	0.17	2	10-15
	8-14	5-15	0.75-1.10	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.20		
	14-30	5-15	0.80-1.20	0.6-2.0	0.08-0.15	5.1-6.0	Low-----	0.10		
	30	---	---	---	---	---	-----	---		
76, 77, 78----- Hinker	0-8	---	0.70-1.00	0.6-2.0	0.12-0.17	3.6-5.5	Low-----	0.17	2	10-15
	8-17	---	0.70-1.00	0.6-2.0	0.15-0.25	3.6-5.5	Low-----	0.05		
	17-38	---	0.70-1.00	0.6-2.0	0.10-0.15	5.1-5.5	Low-----	0.05		
	38	---	---	---	---	---	-----	---		
79----- Humaquepts	0-5	5-15	1.15-1.30	0.6-2.0	0.18-0.22	4.5-6.5	Low-----	0.37	5	5-10
	5-13	5-20	1.25-1.45	0.6-2.0	0.12-0.20	4.5-6.5	Low-----	0.37		
	13-25	5-35	1.20-1.50	0.6-2.0	0.10-0.18	5.1-6.5	Low-----	0.32		
	25-60	5-35	1.20-1.60	0.2-0.6	0.05-0.18	5.1-6.5	Low-----	0.20		
80, 81, 82----- Index	0-7	---	0.70-1.10	6.0-20	0.08-0.12	4.5-6.0	Low-----	0.15	3	10-15
	7-15	---	0.70-1.20	6.0-20	0.05-0.10	5.1-6.0	Low-----	0.10		
	15-23	0-2	1.15-1.40	6.0-20	0.04-0.07	5.1-6.0	Low-----	0.10		
	23-57	0-2	1.30-1.55	>20	0.03-0.05	5.1-6.0	Low-----	0.02		
83*: Index-----	0-7	---	0.70-1.10	6.0-20	0.08-0.12	4.5-6.0	Low-----	0.15	3	10-15
	7-15	---	0.70-1.20	6.0-20	0.05-0.10	5.1-6.0	Low-----	0.10		
	15-23	0-2	1.15-1.40	6.0-20	0.04-0.07	5.1-6.0	Low-----	0.10		
	23-57	0-2	1.30-1.55	>20	0.03-0.05	5.1-6.0	Low-----	0.02		
84, 85----- Jonas	0-6	---	0.85-1.00	0.6-2.0	0.20-0.30	5.1-6.0	Moderate----	0.17	3	5-10
	6-43	---	0.85-1.15	0.6-2.0	0.10-0.20	5.1-6.0	Moderate----	0.20		
	43-54	---	0.85-1.15	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.17		
	54	---	---	---	---	---	-----	---		
86, 87, 88----- Jonas	0-16	---	0.85-1.00	0.6-2.0	0.20-0.30	5.1-6.0	Low-----	0.17	5	5-10
	16-60	---	0.85-1.15	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.20		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
89, 90, 91----- Kaleetan	0-4	5-15	0.60-0.85	2.0-6.0	0.15-0.25	4.5-5.0	Low-----	0.20	5	4-10
	4-9	5-15	0.65-0.85	0.6-2.0	0.10-0.15	5.1-5.5	Low-----	0.20		
	9-35	5-15	0.65-0.95	0.6-2.0	0.08-0.12	4.5-5.5	Low-----	0.10		
	35-60	5-15	0.85-1.35	2.0-6.0	0.05-0.08	5.6-6.0	Low-----	0.05		
92, 93----- Kaleetan	0-5	5-15	0.60-0.85	2.0-6.0	0.15-0.25	4.5-5.0	Low-----	0.20	3	4-10
	5-12	5-15	0.60-0.85	0.6-2.0	0.10-0.15	5.1-5.5	Low-----	0.20		
	12-23	5-15	0.65-0.95	0.6-2.0	0.08-0.12	4.5-5.5	Low-----	0.10		
	23-41	5-15	0.85-1.35	2.0-6.0	0.05-0.08	5.6-6.0	Low-----	0.05		
	41	---	---	---	---	---	-----	---		
94, 95----- Kaleetan	0-6	5-15	0.60-0.85	2.0-6.0	0.15-0.25	4.5-5.0	Low-----	0.20	5	4-10
	6-17	5-15	0.65-0.85	0.6-2.0	0.10-0.15	5.1-5.5	Low-----	0.20		
	17-34	5-15	0.65-0.95	0.6-2.0	0.08-0.12	4.5-5.5	Low-----	0.10		
	34-60	5-15	0.85-1.35	2.0-6.0	0.05-0.08	5.6-6.0	Low-----	0.05		
96, 97----- Kanaskat	0-11	5-15	0.85-1.00	2.0-6.0	0.15-0.20	5.1-6.0	Low-----	0.15	5	3-9
	11-23	5-15	0.85-1.10	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.10		
	23-38	5-15	0.95-1.20	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.10		
	38-60	5-15	1.00-1.40	2.0-6.0	0.05-0.12	5.1-6.0	Low-----	0.02		
98, 99----- Kanaskat	0-7	5-15	0.85-1.00	2.0-6.0	0.15-0.20	5.1-6.0	Low-----	0.15	5	3-9
	7-18	5-15	0.85-1.10	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.10		
	18-30	5-15	0.95-1.20	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.10		
	30-60	5-15	1.00-1.40	2.0-6.0	0.05-0.12	5.1-6.0	Low-----	0.02		
100, 101, 102---- Kapowsin	0-9	7-15	0.85-1.10	0.6-2.0	0.15-0.22	5.6-6.5	Low-----	0.15	2	3-9
	9-24	7-15	0.85-1.10	0.6-2.0	0.18-0.25	5.1-6.5	Low-----	0.32		
	24-37	5-15	1.20-1.40	0.6-2.0	0.12-0.18	5.1-6.5	Low-----	0.24		
	37	---	---	---	---	---	-----	---		
103, 104, 105---- Kindy	0-6	7-15	0.85-1.00	0.6-2.0	0.20-0.35	4.5-5.5	Low-----	0.20	2	5-10
	6-10	7-15	0.85-1.00	0.6-2.0	0.15-0.30	4.5-5.5	Low-----	0.15		
	10-23	7-15	0.95-1.20	0.6-2.0	0.15-0.20	4.5-5.5	Low-----	0.10		
	23-32	5-15	1.00-1.20	0.6-2.0	0.10-0.20	4.5-5.5	Low-----	0.10		
	32	---	---	---	---	---	-----	---		
106----- Klaber	0-6	15-25	0.90-1.20	0.6-2.0	0.19-0.21	4.5-5.5	Low-----	0.32	5	1-5
	6-22	25-42	1.10-1.30	0.2-0.6	0.19-0.21	4.5-5.5	Moderate----	0.28		
	22-60	35-42	1.25-1.45	0.06-0.2	0.12-0.14	5.1-6.0	High-----	0.24		
107*: Klaber-----	0-6	15-25	0.90-1.20	0.6-2.0	0.19-0.21	4.5-5.5	Low-----	0.32	5	1-5
	6-22	25-42	1.10-1.30	0.2-0.6	0.19-0.21	4.5-5.5	Moderate----	0.28		
	22-60	35-42	1.25-1.45	0.06-0.2	0.12-0.14	5.1-6.0	High-----	0.24		
Cinebar-----	0-10	---	0.65-0.85	0.6-2.0	0.30-0.40	4.5-7.3	Low-----	0.28	5	3-9
	10-54	---	0.65-0.85	0.6-2.0	0.25-0.35	5.1-6.5	Low-----	0.32		
	54-60	---	0.65-1.00	0.6-2.0	0.20-0.30	5.1-7.3	Low-----	0.32		
108, 109----- Klapatche	0-8	1-5	0.85-1.10	2.0-6.0	0.08-0.12	4.5-6.0	Low-----	0.20	2	10-15
	8-12	2-10	0.85-1.10	2.0-6.0	0.06-0.10	5.1-6.0	Low-----	0.15		
	12-20	2-10	0.85-1.10	2.0-6.0	0.04-0.07	5.1-6.0	Low-----	0.05		
	20-31	0-3	0.85-1.10	6.0-20	0.02-0.04	5.1-6.0	Low-----	0.02		
	31-38	---	---	---	---	---	-----	---		
	38	---	---	---	---	---	-----	---		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
110*: Klapatche-----	0-8	1-5	0.85-1.10	2.0-6.0	0.08-0.12	4.5-6.0	Low-----	0.20	2	10-15
	8-12	2-10	0.85-1.10	2.0-6.0	0.06-0.10	5.1-6.0	Low-----	0.15		
	12-20	2-10	0.85-1.10	2.0-6.0	0.04-0.07	5.1-6.0	Low-----	0.05		
	20-31	0-3	0.85-1.10	6.0-20	0.02-0.04	5.1-6.0	Low-----	0.02		
	31-38	---	---	---	---	---	-----	---		
	38	---	---	---	---	---	-----	---		
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
111, 112, 113, 114, 115----- Klaus	0-2	2-10	0.80-1.10	2.0-6.0	0.15-0.20	4.5-5.5	Low-----	0.20	1	5-10
	2-16	2-10	0.80-1.10	2.0-6.0	0.15-0.20	4.5-5.5	Low-----	0.20		
	16-28	0-3	1.20-1.40	6.0-20	0.03-0.05	5.1-6.0	Low-----	0.10		
	28	---	---	---	---	---	-----	---		
116, 117----- Larrupin	0-6	0-2	0.60-1.00	6.0-20	0.08-0.12	6.1-6.5	Low-----	0.15	3	3-8
	6-24	2-10	0.60-1.10	2.0-6.0	0.06-0.10	6.1-6.5	Low-----	0.10		
	24-35	3-10	1.10-1.40	0.6-2.0	0.05-0.08	6.1-6.5	Low-----	0.05		
	35-60	2-10	1.40-1.65	0.6-2.0	0.04-0.08	6.1-6.5	Low-----	0.02		
118----- Larrupin	0-6	---	0.85-1.00	2.0-6.0	0.10-0.12	5.1-6.5	Low-----	0.10	3	5-10
	6-17	---	0.65-0.85	2.0-6.0	0.08-0.10	5.6-6.5	Low-----	0.10		
	17-35	---	0.90-1.10	0.6-2.0	0.14-0.16	6.1-6.5	Low-----	0.15		
	35-52	---	0.95-1.30	0.6-2.0	0.10-0.15	6.1-6.5	Low-----	0.15		
	52	---	---	---	---	---	-----	---		
119----- Lemolo	0-5	10-20	0.85-1.15	0.6-2.0	0.25-0.35	4.5-5.5	Low-----	0.37	5	3-15
	5-17	10-20	1.00-1.30	0.6-2.0	0.20-0.30	4.5-5.5	Low-----	0.37		
	17-60	10-30	1.45-1.70	0.06-0.2	0.08-0.10	5.6-6.5	Low-----	0.10		
120, 121, 122--- Littlejohn	0-11	5-10	0.75-0.95	0.6-2.0	0.15-0.20	5.1-6.0	Low-----	0.15	2	4-10
	11-17	5-15	0.85-1.10	0.6-2.0	0.10-0.15	5.6-6.0	Low-----	0.15		
	17-30	5-15	0.85-1.15	0.6-2.0	0.10-0.15	5.6-6.0	Low-----	0.10		
	30	---	---	---	---	---	-----	---		
123, 124----- Littlejohn	0-7	5-10	0.75-0.95	0.6-2.0	0.15-0.20	5.1-6.0	Low-----	0.15	2	4-10
	7-18	5-15	0.85-1.10	0.6-2.0	0.10-0.15	5.6-6.0	Low-----	0.15		
	18-27	5-15	0.85-1.15	0.6-2.0	0.10-0.15	5.6-6.0	Low-----	0.10		
	27	---	---	---	---	---	-----	---		
125----- Littlejohn	0-11	5-10	0.75-0.95	0.6-2.0	0.15-0.20	5.1-6.0	Low-----	0.15	2	4-10
	11-17	5-15	0.85-1.10	0.6-2.0	0.10-0.15	5.6-6.0	Low-----	0.15		
	17-30	5-15	0.85-1.15	0.6-2.0	0.10-0.15	5.6-6.0	Low-----	0.10		
	30	---	---	---	---	---	-----	---		
126*: Littlejohn-----	0-11	5-10	0.75-0.95	0.6-2.0	0.15-0.20	5.1-6.0	Low-----	0.15	2	4-10
	11-17	5-15	0.85-1.10	0.6-2.0	0.10-0.15	5.6-6.0	Low-----	0.15		
	17-30	5-15	0.85-1.15	0.6-2.0	0.10-0.15	5.6-6.0	Low-----	0.10		
	30	---	---	---	---	---	-----	---		
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
127----- Lynnwood	0-6	0-5	0.85-1.20	2.0-6.0	0.08-0.11	5.1-6.0	Low-----	0.24	5	2-6
	6-21	0-5	1.10-1.30	6.0-20	0.07-0.10	5.1-6.5	Low-----	0.24		
	21-60	0-5	1.25-1.50	6.0-20	0.05-0.08	5.1-7.3	Low-----	0.17		
128, 129----- Marblemount	0-5	0-8	0.85-1.10	6.0-20	0.06-0.10	5.1-6.0	Low-----	0.10	2	3-8
	5-35	0-2	1.40-1.60	2.0-6.0	0.05-0.07	5.1-6.0	Low-----	0.05		
	35	---	---	---	---	---	-----	---		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
130----- Marblemount	0-7 7-16 16-38 38	0-2 0-10 0-2 ---	0.85-1.10 1.30-1.50 1.40-1.60 ---	6.0-20.0 6.0-20.0 6.0-20.0 ---	0.06-0.10 0.05-0.08 0.05-0.07 ---	5.1-6.0 5.1-6.0 5.1-6.0 ---	Low----- Low----- Low----- -----	0.10 0.10 0.05 ---	2	3-8
131*: Marblemount-----	0-5 5-35 35	0-8 0-2 ---	0.85-1.10 1.40-1.60 ---	6.0-20 2.0-6.0 ---	0.06-0.10 0.05-0.07 ---	5.1-6.0 5.1-6.0 ---	Low----- Low----- -----	0.10 0.05 ---	2	3-8
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
132, 133----- Mashel	0-7 7-13 13-60	18-27 18-27 35-45	1.15-1.35 1.25-1.45 1.20-1.40	0.6-2.0 0.6-2.0 0.2-0.6	0.16-0.20 0.16-0.19 0.15-0.18	4.5-6.0 4.5-6.0 4.5-6.0	Low----- Low----- Moderate----	0.32 0.28 0.28	5	3-8
134, 135, 136---- Melakwa	0-7 7-22 22-37 37	5-10 5-15 5-15 ---	0.60-0.85 0.60-0.95 0.85-1.20 ---	2.0-6.0 0.6-2.0 0.6-2.0 ---	0.15-0.20 0.10-0.15 0.08-0.15 ---	4.5-5.0 5.1-5.5 5.1-5.5 ---	Low----- Low----- Low----- -----	0.28 0.10 0.05 ---	2	4-10
137----- Melakwa	0-8 8-18 18-31 31	5-10 5-15 5-15 ---	0.60-0.85 0.60-0.95 0.85-1.20 ---	2.0-6.0 0.6-2.0 0.6-2.0 ---	0.15-0.20 0.10-0.15 0.08-0.15 ---	4.5-5.0 5.1-5.5 5.1-5.5 ---	Low----- Low----- Low----- -----	0.28 0.10 0.05 ---	2	4-10
138*: Melakwa-----	0-7 7-22 22-37 37	5-10 5-15 5-15 ---	0.60-0.85 0.60-0.95 0.85-1.20 ---	2.0-6.0 0.6-2.0 0.6-2.0 ---	0.15-0.20 0.10-0.15 0.08-0.15 ---	4.5-5.0 5.1-5.5 5.1-5.5 ---	Low----- Low----- Low----- -----	0.28 0.10 0.05 ---	2	4-10
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
139----- Mowich	0-7 7-26 26-60	5-15 5-18 45-60	0.70-0.85 0.75-0.85 1.20-1.35	0.6-2.0 0.6-2.0 0.06-0.2	0.30-0.40 0.25-0.35 0.15-0.20	4.5-5.5 4.5-5.5 4.5-5.5	Low----- Low----- High-----	0.28 0.32 0.28	5	5-10
140----- Mukilteo	0-10 10-60	--- ---	--- ---	2.0-6.0 0.6-2.0	0.40-0.80 0.32-0.40	4.5-5.0 4.5-5.0	Low----- Low-----	0.00 0.00	5	40-80
141, 142----- Nagrom	0-4 4-7 7-23 23-38 38	2-10 2-15 2-15 5-18 ---	0.60-0.90 0.60-0.85 0.60-0.95 0.85-1.15 ---	2.0-6.0 0.6-2.0 0.6-2.0 0.6-2.0 ---	0.15-0.25 0.15-0.25 0.15-0.20 0.10-0.15 ---	5.1-5.5 4.5-6.0 5.6-6.0 5.6-6.0 ---	Low----- Low----- Low----- Low----- -----	0.17 0.20 0.15 0.10 ---	2	10-15
143, 144----- Nagrom	0-4 4-10 10-25 25-34 34	7-15 5-15 5-15 5-18 ---	0.60-0.85 0.60-0.85 0.60-0.85 0.85-1.15 ---	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0 ---	0.15-0.20 0.15-0.20 0.10-0.15 0.10-0.15 ---	4.5-5.5 4.5-6.0 5.6-6.0 5.6-6.0 ---	Low----- Low----- Low----- Low----- -----	0.17 0.17 0.15 0.10 ---	2	10-15
145*: Nagrom-----	0-4 4-7 7-23 23-38 38	2-10 2-15 2-15 5-18 ---	0.60-0.90 0.60-0.85 0.60-0.95 0.85-1.15 ---	2.0-6.0 0.6-2.0 0.6-2.0 0.6-2.0 ---	0.15-0.25 0.15-0.25 0.15-0.20 0.10-0.15 ---	5.1-5.5 4.5-6.0 5.6-6.0 5.6-6.0 ---	Low----- Low----- Low----- Low----- -----	0.17 0.20 0.15 0.10 ---	2	10-15
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
146, 147----- Nargar	0-2 2-24 24-60	2-10 5-15 0-5	0.85-0.95 0.85-1.10 1.35-1.55	0.6-2.0 0.6-2.0 6.0-20	0.20-0.25 0.15-0.25 0.05-0.08	5.1-6.5 5.1-6.5 6.1-6.5	Low----- Low----- Low-----	0.32 0.24 0.17	3	3-9
148*: Nargar-----	0-2 2-24 24-60	2-10 5-15 0-5	0.85-0.95 0.85-1.10 1.35-1.55	0.6-2.0 0.6-2.0 6.0-20	0.20-0.25 0.15-0.25 0.05-0.08	5.1-6.5 5.1-6.5 6.1-6.5	Low----- Low----- Low-----	0.32 0.24 0.17	3	3-9
Pastik-----	0-6 6-29 29-60	--- --- 18-30	0.60-0.85 0.85-1.10 1.30-1.55	0.6-2.0 0.6-2.0 0.06-0.2	0.25-0.35 0.25-0.35 0.15-0.20	5.1-6.5 5.1-6.5 5.1-6.5	Low----- Low----- Moderate----	0.32 0.32 0.43	5	10-15
149----- National	0-10 10-28 28-46 46-60	--- --- --- 10-25	0.60-0.85 0.60-0.85 0.60-0.85 0.85-1.10	2.0-6.0 6.0-20 0.6-2.0 0.6-2.0	0.11-0.15 0.08-0.12 0.14-0.18 0.12-0.16	5.6-6.5 5.6-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low----- Low-----	0.15 0.10 0.24 0.20	5	5-10
150----- Neilton	0-16 16-21 21-60	0-5 0-5 0-5	1.25-1.45 1.40-1.60 1.40-1.60	6.0-20 >20 >20	0.05-0.07 0.03-0.05 0.02-0.04	5.1-6.0 5.1-6.0 5.6-7.3	Low----- Low----- Low-----	0.15 0.05 0.05	5	2-10
151, 152, 153---- Nimue	0-5 5-10 10-24 24-60	0-3 2-10 5-15 5-15	0.65-0.85 0.65-1.00 0.85-1.10 0.90-1.20	6.0-20 2.0-6.0 0.6-2.0 0.6-2.0	0.07-0.10 0.08-0.15 0.10-0.15 0.06-0.10	4.5-5.0 4.5-6.0 5.6-6.5 5.6-6.5	Low----- Low----- Low----- Low-----	0.17 0.20 0.05 0.05	5	10-15
154, 155----- Nimue	0-6 6-15 15-32 32-60	0-3 2-10 5-15 5-15	0.65-0.85 0.65-1.00 0.85-1.10 0.90-1.20	6.0-20 2.0-6.0 0.6-2.0 0.6-2.0	0.07-0.10 0.08-0.15 0.10-0.15 0.06-0.10	4.5-5.0 4.5-6.0 5.6-6.5 5.6-6.5	Low----- Low----- Low----- Low-----	0.17 0.20 0.05 0.05	5	10-15
156*: Nimue-----	0-5 5-10 10-24 24-60	0-3 2-10 5-15 5-15	0.65-0.85 0.65-1.00 0.85-1.10 0.90-1.20	6.0-20 2.0-6.0 0.6-2.0 0.6-2.0	0.07-0.10 0.08-0.15 0.10-0.15 0.06-0.10	4.5-5.0 4.5-6.0 5.6-6.5 5.6-6.5	Low----- Low----- Low----- Low-----	0.17 0.20 0.05 0.05	5	10-15
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
157----- Nooksack	0-11 11-29 29-60	10-15 10-15 10-15	1.15-1.35 1.30-1.50 1.30-1.50	0.6-2.0 0.6-2.0 0.6-2.0	0.18-0.21 0.18-0.21 0.17-0.20	5.6-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low-----	0.37 0.43 0.43	5	1-5
158----- Norma	0-9 9-33 33-60	5-15 5-15 2-10	1.15-1.35 1.30-1.45 1.25-1.45	0.6-2.0 2.0-6.0 2.0-6.0	0.19-0.21 0.10-0.14 0.07-0.09	6.1-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low-----	0.37 0.20 0.10	4	3-8
159----- Oakes	0-8 8-60	5-15 5-15	0.85-1.00 0.85-1.00	0.6-2.0 0.6-2.0	0.20-0.30 0.10-0.15	5.1-6.0 5.1-6.0	Low----- Low-----	0.24 0.10	5	4-10
160----- Oakes	0-6 6-44 44	7-15 5-15 ---	0.85-1.00 0.85-1.00 ---	0.6-2.0 0.6-2.0 ---	0.15-0.20 0.10-0.15 ---	5.1-6.0 5.1-6.0 ---	Low----- Low----- -----	0.20 0.10 ---	3	4-10
161----- Oakes	0-6 6-44 44	7-15 5-15 ---	0.85-1.00 0.85-1.00 ---	0.6-2.0 0.6-2.0 ---	0.15-0.20 0.10-0.15 ---	5.1-6.0 5.1-6.0 ---	Low----- Low----- -----	0.20 0.10 ---	3	4-10

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
162, 163----- Ogarty	0-4	7-15	0.60-0.90	0.6-2.0	0.15-0.20	4.5-6.0	Low-----	0.20	2	5-10
	4-37	5-18	0.85-1.10	0.6-2.0	0.08-0.15	4.5-6.0	Low-----	0.05		
	37	---	---	---	---	---	-----	---		
164*: Ogarty-----	0-4	7-15	0.60-0.90	0.6-2.0	0.15-0.20	4.5-6.0	Low-----	0.20	2	5-10
	4-37	5-18	0.85-1.10	0.6-2.0	0.08-0.15	4.5-6.0	Low-----	0.05		
	37	---	---	---	---	---	-----	---		
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
165----- Ohop	0-7	10-20	1.10-1.30	2.0-6.0	0.12-0.16	5.1-6.0	Low-----	0.24	5	4-10
	7-16	5-15	1.50-1.80	0.6-2.0	0.05-0.08	5.1-6.0	Low-----	0.10		
	16-60	5-15	1.30-1.50	0.06-0.2	0.04-0.08	5.1-6.0	Low-----	0.05		
166----- Ohop	0-7	15-25	1.15-1.35	0.6-2.0	0.09-0.12	5.1-6.0	Low-----	0.20	2	4-10
	7-16	5-15	1.50-1.80	0.6-2.0	0.05-0.08	5.1-6.0	Low-----	0.10		
	16-60	5-15	1.30-1.50	0.06-0.2	0.04-0.08	5.1-6.0	Low-----	0.05		
167, 168----- Olomount	0-6	7-15	0.60-0.85	0.6-2.0	0.15-0.20	5.1-6.0	Low-----	0.20	2	5-10
	6-14	5-18	0.85-1.00	0.6-2.0	0.15-0.20	5.6-6.0	Low-----	0.15		
	14-33	5-18	0.85-1.10	0.6-2.0	0.10-0.15	5.6-6.5	Low-----	0.10		
	33	---	---	---	---	---	-----	---		
169*: Olomount-----	0-6	7-15	0.60-0.85	0.6-2.0	0.15-0.20	5.1-6.0	Low-----	0.20	2	5-10
	6-14	5-18	0.85-1.00	0.6-2.0	0.15-0.20	5.6-6.0	Low-----	0.15		
	14-33	5-18	0.85-1.10	0.6-2.0	0.10-0.15	5.6-6.5	Low-----	0.10		
	33	---	---	---	---	---	-----	---		
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
170----- Oridia	0-11	8-18	1.15-1.25	0.6-2.0	0.19-0.21	5.6-6.5	Low-----	0.49	5	2-6
	11-19	8-18	1.15-1.25	0.6-2.0	0.19-0.21	5.6-7.3	Low-----	0.55		
	19-60	8-35	1.20-1.30	0.6-2.0	0.15-0.20	5.6-7.3	Moderate----	0.55		
171*: Orthents-----	0-6	5-12	1.20-1.40	2.0-6.0	0.05-0.10	5.1-5.5	Low-----	0.10	2	2-8
	6-24	0-10	1.30-1.50	2.0-20	0.03-0.06	5.1-5.5	Low-----	0.10		
	24-30	0-10	1.25-1.45	2.0-20	0.03-0.06	5.1-5.5	Low-----	0.05		
	30	---	---	---	---	---	-----	---		
Humods-----	0-6	5-12	1.15-1.30	2.0-6.0	0.05-0.10	5.1-5.5	Low-----	0.10	2	10-15
	6-14	0-10	1.25-1.55	2.0-20	0.03-0.06	5.1-5.5	Low-----	0.10		
	14-26	0-10	1.25-1.55	2.0-20	0.03-0.06	5.1-5.5	Low-----	0.05		
	26	---	---	---	---	---	-----	---		
172, 173----- Ovall	0-3	7-15	0.95-1.30	2.0-6.0	0.13-0.15	5.1-6.5	Low-----	0.17	2	3-8
	3-24	5-15	1.20-1.40	0.6-2.0	0.08-0.10	5.1-6.5	Low-----	0.10		
	24	---	---	---	---	---	-----	---		
174----- Pastik	0-6	---	0.60-0.85	0.6-2.0	0.25-0.35	5.1-6.5	Low-----	0.32	5	10-15
	6-31	---	0.85-1.10	0.6-2.0	0.25-0.35	5.1-6.5	Low-----	0.32		
	31-60	18-30	1.30-1.55	0.06-0.2	0.15-0.20	5.1-6.5	Moderate----	0.43		
175, 176----- Persis	0-4	---	0.85-1.10	0.6-2.0	0.15-0.20	3.6-5.0	Low-----	0.28	3	4-8
	4-13	---	0.85-1.10	0.6-2.0	0.15-0.25	4.5-5.5	Low-----	0.28		
	13-29	---	0.85-1.10	0.6-2.0	0.15-0.20	5.1-6.0	Low-----	0.32		
	29-60	0-5	1.35-1.55	6.0-20	0.04-0.08	5.6-6.0	Low-----	0.10		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
177, 178----- Pheenev	0-11 11-34 34	--- --- ---	0.60-0.85 0.85-1.10 ---	0.6-2.0 0.6-2.0 ---	0.20-0.30 0.08-0.15 ---	5.1-6.0 5.1-6.0 ---	Low----- Low----- -----	0.17 0.05 ---	2	5-10
179, 180----- Pheenev	0-4 4-12 12-34 34	--- --- --- ---	0.60-0.85 0.85-0.95 0.85-1.10 ---	0.6-2.0 0.6-2.0 0.6-2.0 ---	0.20-0.30 0.20-0.30 0.10-0.15 ---	5.1-6.0 5.1-6.0 5.1-6.0 ---	Low----- Low----- Low----- -----	0.17 0.10 0.05 ---	2	5-10
181*: Pheenev-----	0-11 11-34 34	--- --- ---	0.60-0.85 0.85-1.10 ---	0.6-2.0 0.6-2.0 ---	0.20-0.30 0.08-0.15 ---	5.1-6.0 5.1-6.0 ---	Low----- Low----- -----	0.17 0.05 ---	2	5-10
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
182, 183----- Philippa	0-4 4-9 9-18 18-28 28	3-10 5-18 5-18 5-18 ---	0.85-1.10 0.85-1.10 0.85-1.10 0.85-1.10 ---	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0 ---	0.15-0.20 0.20-0.25 0.15-0.20 0.10-0.15 ---	3.6-5.0 4.5-5.0 4.5-5.5 4.5-5.5 ---	Low----- Low----- Low----- Low----- -----	0.32 0.28 0.20 0.10 ---	2	4-10
184----- Pierking	0-6 6-34 34-60	5-18 5-18 2-15	1.10-1.30 1.20-1.40 1.55-1.75	2.0-6.0 0.2-0.6 0.2-0.6	0.07-0.09 0.03-0.08 0.03-0.08	5.1-6.0 5.1-6.0 5.1-6.5	Low----- Low----- Low-----	0.28 0.10 0.05	5	5-10
185*: Pierking-----	0-6 6-34 34-60	5-18 5-18 2-15	1.10-1.30 1.20-1.40 1.55-1.75	2.0-6.0 0.2-0.6 0.2-0.6	0.07-0.09 0.03-0.08 0.03-0.08	5.1-6.0 5.1-6.0 5.1-6.5	Low----- Low----- Low-----	0.28 0.10 0.05	5	5-10
Borohemists-----	0-4 4-30 30-60	--- --- ---	--- --- ---	0.6-2.0 0.6-2.0 ---	0.30-0.40 0.30-0.40 ---	4.5-6.0 4.5-6.0 ---	Low----- Low----- -----	0.02 0.02 ---	5	40-80
186*: Pierking-----	0-6 6-34 34-60	5-18 5-18 2-15	1.10-1.30 1.20-1.40 1.55-1.75	2.0-6.0 0.2-0.6 0.2-0.6	0.07-0.09 0.03-0.08 0.03-0.08	5.1-6.0 5.1-6.0 5.1-6.5	Low----- Low----- Low-----	0.28 0.10 0.05	5	5-10
Mowich-----	0-7 7-26 26-60	5-15 5-18 45-60	0.70-0.85 0.75-0.85 1.20-1.35	0.6-2.0 0.6-2.0 0.06-0.2	0.30-0.40 0.25-0.35 0.15-0.20	4.5-5.5 4.5-5.5 4.5-5.5	Low----- Low----- High-----	0.28 0.32 0.28	5	5-10
187----- Pilchuck	0-9 9-55 55-60	0-5 0-5 0-5	1.50-1.60 1.50-1.60 1.60-1.65	6.0-20 6.0-20 >20	0.05-0.07 0.05-0.08 0.03-0.05	6.1-7.3 5.6-7.3 6.1-7.3	Low----- Low----- Low-----	0.10 0.10 0.05	5	1-2
188, 189, 190---- Pitcher	0-8 8-16 16-29 29-60	3-10 3-15 3-15 3-18	0.65-0.85 0.85-1.00 0.85-1.10 0.95-1.30	2.0-6.0 0.6-2.0 0.6-2.0 0.6-2.0	0.15-0.20 0.10-0.15 0.06-0.10 0.06-0.10	5.1-6.0 5.1-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low----- Low-----	0.28 0.20 0.10 0.10	5	4-10
191, 192, 193---- Pitcher	0-7 7-13 13-29 29-60	3-10 3-15 3-15 3-18	0.65-0.85 0.85-1.00 0.85-1.10 0.95-1.30	2.0-6.0 0.6-2.0 0.6-2.0 0.6-2.0	0.15-0.20 0.10-0.15 0.06-0.10 0.06-0.10	5.1-6.0 5.1-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low----- Low-----	0.28 0.20 0.10 0.10	5	4-10

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
194*:										
Pitcher-----	0-8	3-10	0.65-0.85	2.0-6.0	0.15-0.20	5.1-6.0	Low-----	0.28	5	4-10
	8-16	3-15	0.85-1.00	0.6-2.0	0.10-0.15	5.1-6.5	Low-----	0.20		
	16-29	3-15	0.85-1.10	0.6-2.0	0.06-0.10	5.6-6.5	Low-----	0.10		
	29-60	3-18	0.95-1.30	0.6-2.0	0.06-0.10	5.6-6.5	Low-----	0.10		
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
195*-----	0-60	---	---	---	---	---	-----	---	---	---
Pits										
196, 197, 198----	0-6	2-5	0.80-1.00	6.0-20	0.10-0.15	4.5-5.0	Low-----	0.17	5	10-15
Playco	6-10	2-10	0.75-1.00	2.0-6.0	0.10-0.20	5.1-6.5	Low-----	0.10		
	10-36	5-15	0.75-1.10	0.6-2.0	0.10-0.15	5.6-6.5	Low-----	0.10		
	36-60	5-15	0.85-1.20	0.6-2.0	0.10-0.15	5.1-6.5	Low-----	0.10		
199, 200-----	0-7	2-5	0.80-1.00	>20	0.03-0.08	4.5-5.5	Low-----	0.10	5	10-15
Playco	7-17	2-5	0.85-1.10	>20	0.03-0.08	5.1-6.0	Low-----	0.10		
	17-50	5-15	0.75-1.10	0.6-2.0	0.10-0.15	5.1-6.5	Low-----	0.10		
	50-60	5-15	0.85-1.30	0.6-2.0	0.10-0.15	5.1-6.5	Low-----	0.10		
201*:										
Playco-----	0-6	2-5	0.80-1.00	6.0-20	0.10-0.15	4.5-5.0	Low-----	0.17	5	10-15
	6-10	2-10	0.75-1.00	2.0-6.0	0.10-0.20	5.1-6.5	Low-----	0.10		
	10-36	5-15	0.75-1.10	0.6-2.0	0.10-0.15	5.6-6.5	Low-----	0.10		
	36-60	5-15	0.85-1.20	0.6-2.0	0.10-0.15	5.1-6.5	Low-----	0.10		
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
202-----	0-7	27-35	1.15-1.25	0.6-2.0	0.19-0.21	5.6-7.3	Moderate----	0.28	5	3-9
Puget	7-45	18-35	1.25-1.35	0.2-0.6	0.19-0.21	4.5-6.5	Moderate----	0.32		
	45-60	18-45	1.25-1.35	0.06-0.2	0.15-0.19	4.5-6.5	Moderate----	0.32		
203, 204-----	0-13	7-15	0.60-0.90	2.0-6.0	0.25-0.35	5.6-6.5	Low-----	0.32	3	3-8
Ragnar	13-24	5-15	0.85-1.20	2.0-6.0	0.13-0.15	5.6-6.5	Low-----	0.24		
	24-60	0-5	1.40-1.60	6.0-20	0.07-0.09	5.6-6.5	Low-----	0.17		
205*:										
Ragnar-----	0-13	7-15	0.60-0.90	2.0-6.0	0.25-0.35	5.6-6.5	Low-----	0.32	3	3-8
	13-24	5-15	0.85-1.20	2.0-6.0	0.13-0.15	5.6-6.5	Low-----	0.24		
	24-60	0-5	1.40-1.60	6.0-20	0.07-0.09	5.6-6.5	Low-----	0.17		
Lynnwood-----	0-6	0-5	0.85-1.20	2.0-6.0	0.08-0.11	5.1-6.0	Low-----	0.24	5	2-6
	6-26	0-5	1.10-1.30	6.0-20	0.07-0.10	5.1-6.5	Low-----	0.24		
	26-60	0-5	1.25-1.50	6.0-20	0.05-0.08	5.1-7.3	Low-----	0.17		
206*:										
Ragnar-----	0-13	7-15	0.60-0.90	2.0-6.0	0.25-0.35	5.6-6.5	Low-----	0.32	3	3-8
	13-24	5-15	0.85-1.20	2.0-6.0	0.13-0.15	5.6-6.5	Low-----	0.24		
	24-60	0-5	1.40-1.60	6.0-20	0.07-0.09	5.6-6.5	Low-----	0.17		
Lynnwood-----	0-6	0-5	0.85-1.20	2.0-6.0	0.08-0.11	5.1-6.0	Low-----	0.24	5	2-6
	6-26	0-5	1.10-1.30	6.0-20	0.07-0.10	5.1-6.5	Low-----	0.24		
	26-60	0-5	1.25-1.50	6.0-20	0.05-0.08	5.1-7.3	Low-----	0.17		
207-----	0-8	---	---	0.6-2.0	0.35-0.45	3.6-5.0	-----	---	---	40-80
Reggad	8-17	---	---	0.6-2.0	0.30-0.40	4.5-6.0	Low-----	---		
	17-60	---	---	>20	---	---	Low-----	0.02		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
208*:										
Reggad-----	0-8	---	---	0.6-2.0	0.35-0.45	3.6-5.0	-----	---	---	40-80
	8-17	---	---	0.6-2.0	0.30-0.40	4.5-6.0	Low-----	---	---	
	17-60	---	---	>20	---	---	Low-----	0.02	---	
Haywire-----	0-4	2-10	0.60-0.85	2.0-6.0	0.10-0.15	4.5-5.0	Low-----	0.20	2	10-15
	4-17	5-15	0.60-0.85	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.20	---	
	17-25	5-15	0.75-1.10	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.20	---	
	25-36	5-15	0.80-1.20	0.6-2.0	0.08-0.15	5.1-6.0	Low-----	0.10	---	
	36	---	---	---	---	---	-----	---	---	
209*:										
Reggad-----	0-8	---	---	0.6-2.0	0.35-0.45	3.6-5.0	-----	---	---	40-80
	8-17	---	---	0.6-2.0	0.30-0.40	4.5-6.0	Low-----	---	---	
	17-60	---	---	>20	---	---	Low-----	0.02	---	
Klapatche-----	0-8	1-5	0.85-1.10	2.0-6.0	0.08-0.12	4.5-6.0	Low-----	0.20	2	10-15
	8-12	2-10	0.85-1.10	2.0-6.0	0.06-0.10	5.1-6.0	Low-----	0.15	---	
	12-20	2-10	0.85-1.10	2.0-6.0	0.04-0.07	5.1-6.0	Low-----	0.05	---	
	20-31	0-3	0.85-1.10	6.0-20	0.02-0.04	5.1-6.0	Low-----	0.02	---	
	31-38	---	---	---	---	---	-----	---	---	
	38	---	---	---	---	---	-----	---	---	
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
210*:										
Reggad-----	0-8	---	---	0.6-2.0	0.35-0.45	3.6-5.0	-----	---	---	40-80
	8-17	---	---	0.6-2.0	0.30-0.40	4.5-6.0	Low-----	---	---	
	17-60	---	---	>20	---	---	Low-----	0.02	---	
Serene-----	0-6	2-10	0.70-0.95	2.0-6.0	0.07-0.09	4.5-6.0	Low-----	0.15	2	10-15
	6-14	2-10	0.75-1.00	2.0-6.0	0.04-0.07	5.1-6.0	Low-----	0.10	---	
	14-30	0-2	1.35-1.65	6.0-20	0.03-0.04	5.1-6.0	Low-----	0.02	---	
	30	---	---	---	---	---	-----	---	---	
211, 212-----	0-10	---	0.85-1.10	0.6-2.0	0.25-0.35	4.5-6.0	Low-----	0.32	3	10-15
Reichel	10-18	---	0.85-1.10	0.6-2.0	0.20-0.35	4.5-6.0	Low-----	0.28	---	
	18-28	---	0.85-1.10	0.6-2.0	0.20-0.30	4.5-6.0	Moderate----	0.20	---	
	28-47	---	0.90-1.20	0.6-2.0	0.10-0.15	4.5-6.0	Low-----	0.10	---	
	47-51	---	---	---	---	---	-----	---	---	
213, 214-----	0-14	---	0.85-1.10	0.6-2.0	0.16-0.18	4.5-6.0	Low-----	0.24	5	10-15
Reichel	14-45	---	0.85-1.10	0.6-2.0	0.13-0.16	4.5-6.0	Low-----	0.20	---	
	45-60	---	0.90-1.20	0.6-2.0	0.09-0.12	4.5-6.0	Low-----	0.10	---	
215*-----	0-60	---	---	---	---	---	-----	---	---	---
Riverwash										
216, 217-----	0-6	7-15	0.65-0.85	0.6-2.0	0.20-0.23	5.1-6.0	Low-----	0.32	5	4-10
Rober	6-30	5-18	0.85-1.10	0.6-2.0	0.15-0.24	5.1-6.5	Low-----	0.32	---	
	30-60	10-30	1.20-1.60	0.06-0.2	0.13-0.20	5.6-6.5	Moderate----	0.43	---	
218*-----	0-60	---	---	---	---	---	-----	---	---	---
Rock outcrop										
219*:										
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
219*:										
Cattcreek-----	0-7	---	0.60-0.85	6.0-20	0.08-0.12	5.6-6.5	Low-----	0.10	3	3-8
	7-11	---	0.65-0.90	6.0-20	0.07-0.11	5.6-6.5	Low-----	0.05		
	11-21	---	0.65-1.00	>20	0.06-0.10	5.6-6.5	Low-----	0.02		
	21-60	---	0.75-1.20	0.6-2.0	0.05-0.10	5.6-6.5	Low-----	0.05		
220*:										
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
Cayuse-----	0-13	---	0.60-0.85	2.0-6.0	0.10-0.13	4.5-6.0	Low-----	0.24	5	3-8
	13-30	---	0.65-0.85	0.6-2.0	0.10-0.15	4.5-6.0	Low-----	0.24		
	30-36	---	0.70-1.10	0.6-2.0	0.10-0.13	4.5-6.0	Low-----	0.20		
	36-60	---	0.85-1.30	0.6-2.0	0.06-0.10	4.5-6.0	Low-----	0.10		
221*:										
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
Haywire-----	0-4	2-10	0.60-0.85	2.0-6.0	0.10-0.15	4.5-5.0	Low-----	0.20	2	10-15
	4-17	5-15	0.60-0.85	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.20		
	17-25	5-15	0.75-1.10	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.20		
	25-36	5-15	0.80-1.20	0.6-2.0	0.08-0.15	5.1-6.0	Low-----	0.10		
	36	---	---	---	---	---	-----	---		
222*:										
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
Rubble land----	0-60	0	---	>20	0.0-0.1	---	Low-----	---	---	<.1
Haywire-----	0-4	2-10	0.60-0.85	2.0-6.0	0.10-0.15	4.5-5.0	Low-----	0.20	2	10-15
	4-17	5-15	0.60-0.85	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.20		
	17-25	5-15	0.75-1.10	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.20		
	25-36	5-15	0.80-1.20	0.6-2.0	0.08-0.15	5.1-6.0	Low-----	0.10		
	36	---	---	---	---	---	-----	---		
223*:										
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
Rubble land----	0-60	0	---	>20	0.0-0.1	---	Low-----	---	---	<.1
Serene-----	0-6	2-10	0.70-0.95	2.0-6.0	0.07-0.09	4.5-6.0	Low-----	0.15	2	10-15
	6-14	2-10	0.75-1.00	2.0-6.0	0.04-0.07	5.1-6.0	Low-----	0.10		
	14-30	0-2	1.35-1.65	6.0-20	0.03-0.04	5.1-6.0	Low-----	0.02		
	30	---	---	---	---	---	-----	---		
224*-----	0-60	0	---	>20	0.0-0.1	---	Low-----	---	---	<.1
Rubble land										
225-----	0-11	---	0.65-0.90	0.6-2.0	0.16-0.20	5.1-5.5	Low-----	0.32	5	4-10
Rugles	11-57	---	0.85-1.10	0.2-0.6	0.14-0.18	5.1-6.0	Moderate----	0.28		
	57-60	27-35	1.30-1.50	0.2-0.6	0.14-0.16	5.6-6.0	Moderate----	0.28		
226-----	0-11	10-18	1.10-1.25	0.6-2.0	0.18-0.21	5.1-6.0	Low-----	0.37	5	3-5
Salal	11-50	10-18	1.10-1.35	0.6-2.0	0.18-0.21	5.6-6.0	Low-----	0.43		
	50-60	10-18	1.20-1.45	0.6-2.0	0.18-0.21	5.6-6.0	Low-----	0.43		
227-----	0-6	5-15	0.65-0.85	0.6-2.0	0.25-0.35	5.1-6.0	Low-----	0.28	5	3-8
Sauk	6-22	5-15	0.85-1.10	0.6-2.0	0.15-0.25	5.1-6.0	Low-----	0.32		
	22-42	5-15	0.90-1.20	0.6-2.0	0.15-0.25	5.1-6.5	Low-----	0.32		
	42-60	0-10	1.50-1.70	6.0-20	0.02-0.07	5.6-6.5	Low-----	0.10		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
228, 229, 230---- Scamman	0-6	20-27	1.15-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Low-----	0.32	5	3-8
	6-14	20-35	1.20-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----	0.28		
	14-27	35-45	1.10-1.30	0.6-2.0	0.18-0.22	5.6-6.5	High-----	0.24		
	27-60	40-60	1.10-1.30	0.06-0.2	0.15-0.18	5.1-6.5	High-----	0.24		
231----- Seattle	0-8	---	---	0.6-2.0	0.35-0.40	4.5-6.0	Low-----	0.00	5	60-80
	8-60	---	---	0.6-2.0	0.35-0.40	4.5-6.0	Low-----	0.00		
232, 233----- Serene	0-6	2-10	0.70-0.95	2.0-6.0	0.07-0.09	4.5-6.0	Low-----	0.15	2	10-15
	6-14	2-10	0.75-1.00	2.0-6.0	0.04-0.07	5.1-6.0	Low-----	0.10		
	14-30	0-2	1.35-1.65	6.0-20	0.03-0.04	5.1-6.0	Low-----	0.02		
	30	---	---	---	---	---	-----	---		
234*: Serene-----	0-6	2-10	0.70-0.95	2.0-6.0	0.07-0.09	4.5-6.0	Low-----	0.15	2	10-15
	6-14	2-10	0.75-1.00	2.0-6.0	0.04-0.07	5.1-6.0	Low-----	0.10		
	14-30	0-2	1.35-1.65	6.0-20	0.03-0.04	5.1-6.0	Low-----	0.02		
	30	---	---	---	---	---	-----	---		
Rock outcrop----	0-60	---	---	---	---	---	-----	---	---	---
235----- Shalcar	0-10	---	0.40-0.60	0.6-2.0	0.15-0.25	4.5-6.0	Low-----	---	5	40-90
	10-20	---	0.30-0.50	0.6-2.0	0.15-0.25	4.5-6.0	Low-----	---		
	20-60	10-35	1.20-1.35	0.6-2.0	0.19-0.21	5.6-6.5	Low-----	0.49		
236----- Si	0-11	5-15	1.15-1.35	0.6-2.0	0.16-0.19	5.6-6.0	Low-----	0.37	5	2-5
	11-22	5-15	1.30-1.50	0.6-2.0	0.16-0.19	5.6-6.0	Low-----	0.43		
	22-60	5-10	1.30-1.50	0.6-2.0	0.16-0.19	5.6-6.5	Low-----	0.43		
237, 238----- Skykomish	0-10	5-10	0.70-0.95	2.0-6.0	0.10-0.20	4.5-6.0	Low-----	0.10	1	5-10
	10-15	5-10	0.65-1.00	2.0-6.0	0.10-0.20	4.5-6.0	Low-----	0.10		
	15-60	0-5	1.40-1.65	>20	0.03-0.05	5.6-6.0	Low-----	0.02		
239----- Skykomish	0-10	5-10	0.70-0.95	2.0-6.0	0.10-0.20	4.5-6.0	Low-----	0.10	1	5-10
	10-15	5-10	0.65-1.00	2.0-6.0	0.10-0.20	4.5-6.0	Low-----	0.10		
	15-60	0-5	1.40-1.65	>20	0.03-0.05	5.6-6.0	Low-----	0.02		
240----- Skykomish	0-5	7-10	0.65-0.85	2.0-6.0	0.15-0.25	4.5-6.0	Low-----	0.17	1	5-10
	5-22	5-10	0.65-1.00	2.0-6.0	0.10-0.20	4.5-6.0	Low-----	0.10		
	22-60	0-5	1.40-1.65	>20	0.03-0.05	5.6-6.0	Low-----	0.02		
241----- Snoqualmie	0-8	0-5	1.35-1.50	6.0-20	0.06-0.09	5.6-7.3	Low-----	0.17	1	.5-2
	8-36	0-5	1.40-1.55	>20	0.02-0.04	5.6-7.3	Low-----	0.02		
	36-60	0-5	1.40-1.55	>20	0.02-0.04	5.6-7.3	Low-----	0.02		
242----- Snoqualmie	0-8	0-5	1.35-1.50	6.0-20	0.06-0.09	5.6-7.3	Low-----	0.17	1	.5-2
	8-36	0-5	1.40-1.55	>20	0.02-0.04	5.6-7.3	Low-----	0.02		
	36-60	0-5	1.40-1.55	>20	0.02-0.04	5.6-7.3	Low-----	0.02		
243----- Spukwush	0-7	1-5	0.85-0.95	6.0-20	0.07-0.09	5.1-5.5	Low-----	0.24	5	2-8
	7-15	5-10	0.85-0.95	6.0-20	0.08-0.10	5.1-5.5	Low-----	0.15		
	15-36	18-27	1.10-1.20	0.6-2.0	0.14-0.16	5.6-6.0	Moderate----	0.37		
	36-60	18-27	1.10-1.20	0.2-0.6	0.16-0.18	5.6-6.5	Moderate----	0.24		
244----- Stahl	0-8	---	0.65-0.85	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.10	2	10-15
	8-15	---	0.85-0.95	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.05		
	15-29	---	0.85-1.10	0.6-2.0	0.05-0.10	5.1-6.0	Low-----	0.05		
	29	---	---	---	---	---	-----	---		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction pH	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
245----- Stahl	0-7	---	0.65-0.85	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.10	2	10-15
	7-17	---	0.85-0.95	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.05		
	17-35	---	0.85-1.10	0.6-2.0	0.05-0.10	5.1-6.0	Low-----	0.05		
	35-60	---	---	---	---	---	-----	---		
246----- Stahl	0-7	---	0.65-0.85	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.10	2	10-15
	7-17	---	0.85-0.95	0.6-2.0	0.10-0.15	5.1-6.0	Low-----	0.05		
	17-35	---	0.85-1.10	0.6-2.0	0.05-0.10	5.1-6.0	Low-----	0.05		
	35	---	---	---	---	---	-----	---		
247----- Sulsavar	0-28	7-15	0.65-1.00	0.6-2.0	0.20-0.30	5.6-6.5	Low-----	0.32	5	2-8
	28-51	5-15	0.85-1.10	2.0-6.0	0.15-0.20	6.1-7.3	Low-----	0.15		
	51-60	3-15	0.95-1.20	2.0-6.0	0.08-0.12	6.1-7.3	Low-----	0.15		
248----- Sultan	0-9	15-20	1.15-1.35	0.6-2.0	0.18-0.20	6.1-7.3	Low-----	0.37	5	5-10
	9-48	20-35	1.30-1.50	0.2-0.6	0.18-0.20	6.1-7.3	Moderate----	0.32		
	48-60	5-15	1.30-1.60	0.6-2.0	0.13-0.17	4.5-7.3	Low-----	0.37		
249, 250, 251---- Teneriffe	0-7	0-5	0.85-1.10	6.0-20	0.10-0.15	5.1-6.0	Low-----	0.17	5	2-6
	7-11	0-10	0.95-1.30	6.0-20	0.07-0.11	5.1-6.0	Low-----	0.15		
	11-21	0-5	1.10-1.45	6.0-20	0.05-0.08	5.1-6.0	Low-----	0.10		
	21-37	0-5	1.30-1.55	6.0-20	0.05-0.07	5.6-6.5	Low-----	0.05		
	37-60	0-5	1.35-1.60	6.0-20	0.02-0.04	5.6-6.5	Low-----	0.02		
252, 253----- Teneriffe	0-6	5-10	0.85-1.10	6.0-20	0.07-0.11	5.1-6.0	Low-----	0.15	1	2-6
	6-11	0-10	0.95-1.30	6.0-20	0.05-0.08	5.1-6.0	Low-----	0.10		
	11-47	0-5	1.30-1.60	6.0-20	0.05-0.07	5.6-6.5	Low-----	0.05		
	47	---	---	---	---	---	-----	---		
254, 255, 256, 257----- Tokul	0-3	5-15	0.65-0.85	0.6-2.0	0.15-0.25	5.1-6.5	Low-----	0.20	2	10-15
	3-31	5-15	0.85-1.10	0.6-2.0	0.15-0.25	5.1-6.5	Low-----	0.20		
	31-37	5-15	0.85-1.20	0.6-2.0	0.10-0.20	5.1-6.5	Low-----	0.20		
	37	---	---	---	---	---	-----	---		
258*: Tokul-----	0-3	5-15	0.65-0.85	0.6-2.0	0.15-0.25	5.1-6.5	Low-----	0.20	2	10-15
	3-31	5-15	0.85-1.10	0.6-2.0	0.15-0.25	5.1-6.5	Low-----	0.20		
	31-37	5-15	0.85-1.20	0.6-2.0	0.10-0.20	5.1-6.5	Low-----	0.20		
	37	---	---	---	---	---	-----	---		
Pastik-----	0-6	---	0.60-0.85	0.6-2.0	0.25-0.35	5.1-6.5	Low-----	0.32	5	10-15
	6-31	---	0.85-1.10	0.6-2.0	0.25-0.35	5.1-6.5	Low-----	0.32		
	31-60	18-30	1.30-1.55	0.06-0.2	0.15-0.20	5.1-6.5	Moderate----	0.43		
259*: Tokul-----	0-3	5-15	0.65-0.85	0.6-2.0	0.15-0.25	5.1-6.5	Low-----	0.20	2	10-15
	3-31	5-15	0.85-1.10	0.6-2.0	0.15-0.25	5.1-6.5	Low-----	0.20		
	31-37	5-15	0.85-1.20	0.6-2.0	0.10-0.20	5.1-6.5	Low-----	0.20		
	37	---	---	---	---	---	-----	---		
Pastik-----	0-6	---	0.60-0.85	0.6-2.0	0.25-0.35	5.1-6.5	Low-----	0.32	5	10-15
	6-31	---	0.85-1.10	0.6-2.0	0.25-0.35	5.1-6.5	Low-----	0.32		
	31-60	18-30	1.30-1.55	0.06-0.2	0.15-0.20	5.1-6.5	Moderate----	0.43		
260----- Treen	0-5	---	0.65-0.85	0.6-2.0	0.16-0.18	5.1-6.5	Low-----	0.28	1	10-15
	5-14	---	0.65-0.85	0.6-2.0	0.09-0.12	5.1-6.5	Low-----	0.24		
	14-18	---	1.10-1.25	2.0-6.0	0.08-0.10	5.1-6.5	Low-----	0.24		
	18	---	---	---	---	---	-----	---		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction pH	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in					Pct
261----- Tukwila	0-41 41-60	--- ---	--- ---	0.6-2.0 0.6-2.0	0.35-0.40 0.35-0.40	4.5-5.5 4.5-5.5	----- -----	0.00 0.00	1	40-90
262, 263----- Tusip	0-6 6-15 15-38 38-43 43	--- --- 10-18 10-18 ---	0.60-0.85 0.70-0.95 0.70-0.95 0.85-1.25 ---	2.0-6.0 2.0-6.0 0.6-2.0 0.6-2.0 ---	0.15-0.20 0.10-0.20 0.10-0.15 0.07-0.10 ---	5.1-6.0 5.1-6.0 5.1-6.0 5.1-6.0 ---	Low----- Low----- Low----- Low----- ---	0.28 0.20 0.17 0.15 ---	3	10-15
264----- Typic Haplorthods	0-3 3-45 45	5-10 5-10 ---	0.85-1.10 0.85-1.10 ---	0.6-2.0 0.6-2.0 ---	0.20-0.30 0.08-0.12 ---	5.1-5.5 5.1-6.0 ---	Low----- Low----- ---	0.15 0.15 ---	2	2-10
265, 266----- Typic Udfluvents	0-5 5-16 16-60	15-25 10-25 5-15	1.00-1.30 1.10-1.35 1.20-1.55	0.6-2.0 0.6-2.0 0.6-2.0	0.14-0.20 0.12-0.16 0.04-0.12	5.1-6.0 5.1-6.0 5.6-6.5	Low----- Low----- Low-----	0.37 0.32 0.05	5	.5-3
267----- Udfluvents	0-6 6-21 21-60	2-10 1-5 1-20	1.00-1.30 1.20-1.45 1.35-1.65	2.0-6.0 2.0-20 2.0-20	0.08-0.10 0.03-0.06 0.03-0.05	5.1-6.0 5.1-6.0 5.6-6.5	Low----- Low----- Low-----	0.15 0.10 0.05	5	.5-3
268, 269----- Vailton	0-10 10-37 37-43 43	--- --- --- ---	0.65-0.85 0.85-1.10 0.90-1.20 ---	0.6-2.0 0.6-2.0 0.6-2.0 ---	0.25-0.35 0.25-0.35 0.20-0.30 ---	5.1-6.0 5.1-6.0 5.1-6.0 ---	Low----- Low----- Low----- ---	0.24 0.24 0.15 ---	3	5-10
270, 271, 272---- Voight	0-11 11-43 43-58 58-60	15-25 27-35 20-35 15-25	1.05-1.20 1.40-1.60 1.40-1.60 1.45-1.65	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0	0.22-0.25 0.12-0.15 0.15-0.18 0.15-0.18	5.1-6.0 5.1-6.0 5.1-6.0 5.1-6.0	Low----- Moderate---- Moderate---- Low-----	0.32 0.20 0.24 0.24	5	5-10
273, 274----- Welcome	0-5 5-35 35-53 53	7-15 5-15 5-10 ---	0.70-1.00 0.80-1.10 0.90-1.20 ---	0.6-2.0 0.6-2.0 0.6-2.0 ---	0.15-0.25 0.10-0.20 0.10-0.15 ---	5.1-6.0 5.1-6.0 5.1-6.0 ---	Low----- Low----- Low----- ---	0.28 0.37 0.37 ---	3	2-8
275, 276, 277---- Wilkeson	0-8 8-16 16-34 34-60	10-25 18-27 25-35 18-35	1.15-1.35 1.30-1.45 1.25-1.45 1.25-1.45	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0	0.12-0.16 0.11-0.14 0.12-0.17 0.15-0.20	5.1-6.0 5.1-6.0 5.1-6.0 5.1-6.5	Low----- Moderate---- Moderate---- Moderate----	0.20 0.20 0.20 0.20	5	5-10
278, 279, 280---- Winston	0-11 11-21 21-34 34-60	5-15 5-15 5-15 0-3	0.95-1.15 0.95-1.15 1.00-1.20 1.50-1.70	0.6-2.0 0.6-2.0 0.6-2.0 >20	0.25-0.35 0.20-0.35 0.15-0.25 0.03-0.05	5.1-6.5 5.1-6.5 5.1-6.5 5.6-7.3	Low----- Low----- Low----- Low-----	0.24 0.24 0.20 0.02	2	3-8
281----- Woodinville	0-7 7-15 15-60	18-27 18-35 18-27	1.15-1.35 1.15-1.35 1.10-1.40	0.6-2.0 0.2-0.6 0.2-0.6	0.20-0.24 0.20-0.24 0.20-0.28	5.1-6.0 4.5-6.0 4.5-6.0	Low----- Low----- Low-----	0.37 0.37 0.00	5	5-10
282----- Zynbar	0-18 18-41 41-60	--- --- ---	0.65-0.85 0.70-0.85 0.70-0.95	0.6-2.0 0.6-2.0 0.6-2.0	0.30-0.40 0.20-0.30 0.25-0.35	5.6-7.3 5.6-7.3 5.6-7.3	Low----- Low----- Low-----	0.24 0.20 0.24	5	5-10
283----- Zynbar	0-18 18-41 41-60	--- --- ---	0.65-0.85 0.70-0.85 0.70-0.95	0.6-2.0 0.6-2.0 0.6-2.0	0.30-0.40 0.20-0.30 0.25-0.35	5.6-7.3 5.6-7.3 5.6-7.3	Low----- Low----- Low-----	0.24 0.20 0.24	5	5-10

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction pH	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
284----- Zynbar	0-9	---	0.65-0.85	0.6-2.0	0.30-0.40	5.6-7.3	Low-----	0.32	4	5-10
	9-29	---	0.60-0.85	0.6-2.0	0.20-0.35	5.6-7.3	Low-----	0.28		
	29-60	---	1.40-1.70	0.2-0.6	0.08-0.13	5.1-6.0	Low-----	0.10		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
1, 2----- Alderwood	C	None-----	---	---	1.5-3.0	Perched	Dec-May
3----- Alkiridge	C	None-----	---	---	1.5-3.0	Perched	Nov-May
4, 5, 6----- Altapeak	B	None-----	---	---	>6.0	---	---
7*: Altapeak-----	B	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
8----- Andic Cryumbrepts	C	None-----	---	---	>6.0	---	---
9----- Arents	B	None-----	---	---	>6.0	---	---
10, 11, 12, 13, 14, 15, 16----- Barneston	B	None-----	---	---	>6.0	---	---
17, 18, 19----- Beausite	C	None-----	---	---	>6.0	---	---
20----- Belfast	B	Occasional-----	Brief-----	Nov-Mar	3.5-6.0	Apparent	Nov-Mar
21, 22----- Bellicum	B	None-----	---	---	>6.0	---	---
23, 24----- Blethen	B	None-----	---	---	>6.0	---	---
25----- Borochemists	D	None-----	---	---	+1-0	Apparent	Oct-Jun
26----- Bromo	B	None-----	---	---	>6.0	---	---
27, 28, 29, 30----- Cattcreek	B	None-----	---	---	>6.0	---	---
31----- Cattcreek	B	None-----	---	---	3.5-5.0	Perched	Nov-May
32, 33----- Cayuse	B	None-----	---	---	>6.0	---	---
34, 35, 36, 37, 38----- Chinkmin	C	None-----	---	---	1.5-3.0	Perched	Nov-Jul
39, 40----- Christoff	C	None-----	---	---	2.5-4.0	Perched	Dec-Apr

See footnote at end of table.

TABLE 16.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
41, 42, 43----- Chuckanut	B	None-----	---	---	>6.0	---	---
44, 45, 46----- Cinebar	B	None-----	---	---	>6.0	---	---
47, 48----- Cotteral	B	None-----	---	---	>6.0	---	---
49----- Crinker	C	None-----	---	---	>6.0	---	---
50----- Cryofluvents	B	Occasional-----	Brief-----	Dec-May	>6.0	---	---
51----- Cryohemists	D	None-----	---	---	+1-0	Apparent	Nov-Jun
52----- Dobbs	C	None-----	---	---	2.5-3.0	Perched	Nov-Mar
53----- Edgewick	C	Occasional-----	Brief-----	Nov-Mar	3.0-4.0	Perched	Feb-Apr
54, 55----- Elwell	C	None-----	---	---	1.5-3.0	Perched	Nov-Jun
56, 57, 58, 59----- Ethanias	B	None-----	---	---	>6.0	---	---
60----- Ethanias	B	None-----	---	---	3.5-5.0	Perched	Nov-May
61, 62----- Foss	B	None-----	---	---	>6.0	---	---
63, 64, 65----- Gallup	B	None-----	---	---	>6.0	---	---
66, 67, 68----- Getchell	C	None-----	---	---	1.5-3.0	Perched	Nov-Apr
69----- Greenwater	A	Rare-----	---	---	>6.0	---	---
70----- Grotto	A	Rare-----	---	---	>6.0	---	---
71----- Hartnit	C	None-----	---	---	>6.0	---	---
72, 73, 74, 75----- Haywire	C	None-----	---	---	>6.0	---	---
76, 77, 78----- Hinker	C	None-----	---	---	>6.0	---	---
79----- Humaquepts	D	Rare-----	---	---	0.5-1.0	Apparent	Dec-Apr

See footnote at end of table.

TABLE 16.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
80, 81, 82----- Index	A	None-----	---	---	>6.0	---	---
83*: Index-----	A	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
84, 85, 86, 87, 88----- Jonas	B	None-----	---	---	>6.0	---	---
89, 90, 91----- Kaleetan	B	None-----	---	---	>6.0	---	---
92, 93----- Kaleetan	C	None-----	---	---	3.0-5.0	Perched	Nov-Mar
94, 95----- Kaleetan	B	None-----	---	---	>6.0	---	---
96, 97, 98, 99----- Kanaskat	B	None-----	---	---	>6.0	---	---
100, 101, 102----- Kapowsin	D	None-----	---	---	1.0-2.0	Perched	Dec-Jun
103, 104, 105----- Kindy	C	None-----	---	---	1.5-3.0	Perched	Nov-Apr
106----- Klaber	D	None-----	---	---	+1-0.5	Perched	Nov-May
107*: Klaber-----	D	None-----	---	---	+1-0.5	Perched	Nov-May
Cinebar-----	B	None-----	---	---	>6.0	---	---
108, 109----- Klapatche	C	None-----	---	---	>6.0	---	---
110*: Klapatche-----	C	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
111, 112, 113, 114, 115----- Klaus	C	None-----	---	---	>6.0	---	---
116, 117, 118----- Larrupin	B	None-----	---	---	>6.0	---	---
119----- Lemolo	D	Rare-----	---	---	0-1.0	Perched	Nov-May
120, 121, 122, 123, 124, 125----- Littlejohn	C	None-----	---	---	>6.0	---	---
126*: Littlejohn-----	C	None-----	---	---	>6.0	---	---

See footnote at end of table.

TABLE 16.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
126*: Rock outcrop-----	D	None-----	---	---	>6.0	---	---
127----- Lynnwood	A	None-----	---	---	>6.0	---	---
128, 129----- Marblemount	B	None-----	---	---	>6.0	---	---
130----- Marblemount	C	None-----	---	---	>6.0	---	---
131*: Marblemount-----	B	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
132, 133----- Mashel	B	None-----	---	---	>6.0	---	---
134, 135, 136, 137----- Melakwa	C	None-----	---	---	>6.0	---	---
138*: Melakwa-----	C	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
139----- Mowich	D	None-----	---	---	1.0-2.0	Perched	Nov-May
140----- Mukilteo	D	None-----	---	---	+1-0	Apparent	Nov-May
141, 142, 143, 144----- Nagrom	C	None-----	---	---	>6.0	---	---
145*: Nagrom-----	C	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
146, 147----- Nargar	B	None-----	---	---	>6.0	---	---
148*: Nargar-----	B	None-----	---	---	>6.0	---	---
Pastik-----	D	None-----	---	---	1.5-2.5	Perched	Dec-May
149----- National	B	None-----	---	---	5.0-6.0	Apparent	Dec-Apr
150----- Neilton	A	None-----	---	---	>6.0	---	---
151, 152, 153, 154, 155----- Nimue	B	None-----	---	---	>6.0	---	---
156*: Nimue-----	B	None-----	---	---	>6.0	---	---

See footnote at end of table.

TABLE 16.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
156*: Rock outcrop-----	D	None-----	---	---	>6.0	---	---
157----- Nooksack	C	Occasional-----	Brief-----	Nov-Mar	3.0-4.0	Perched	Feb-May
158----- Norma	D	None-----	---	---	+1-1.0	Apparent	Nov-May
159, 160, 161----- Oakes	B	None-----	---	---	>6.0	---	---
162, 163----- Ogarty	C	None-----	---	---	>6.0	---	---
164*: Ogarty-----	C	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
165, 166----- Ohop	C	None-----	---	---	2.0-3.0	Perched	Dec-Apr
167, 168----- Olomount	C	None-----	---	---	>6.0	---	---
169*: Olomount-----	C	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
170----- Oridia	D	Occasional-----	Brief-----	Nov-Apr	1.0-3.0	Apparent	Nov-Apr
171*: Orthents-----	C	None-----	---	---	>6.0	---	---
Humods-----	C	None-----	---	---	>6.0	---	---
172, 173----- Ovall	C	None-----	---	---	>6.0	---	---
174----- Pastik	D	None-----	---	---	1.5-2.5	Perched	Dec-May
175, 176----- Persis	B	None-----	---	---	>6.0	---	---
177, 178, 179, 180----- Pheeney	C	None-----	---	---	>6.0	---	---
181*: Pheeney-----	C	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
182, 183----- Philippa	C	None-----	---	---	2.0-3.0	Perched	Dec-Apr

See footnote at end of table.

TABLE 16.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
184----- Pierking	D	Rare-----	---	---	0.5-1.0	Apparent	Nov-Mar
185*: Pierking-----	D	Rare-----	---	---	0.5-1.0	Apparent	Nov-Mar
Borohemists-----	D	Rare-----	---	---	+1-0	Apparent	Oct-Jun
186*: Pierking-----	D	None-----	---	---	0.5-1.0	Apparent	Nov-Mar
Mowich-----	D	None-----	---	---	1.0-2.0	Perched	Nov-May
187----- Pilchuck	C	Occasional-----	Brief-----	Nov-Apr	2.0-4.0	Apparent	Nov-Apr
188, 189, 190, 191, 192, 193----- Pitcher	B	None-----	---	---	>6.0	---	---
194*: Pitcher-----	B	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
195*----- Pits	A	None-----	---	---	>6.0	---	---
196, 197, 198, 199, 200- Playco	B	None-----	---	---	>6.0	---	---
201*: Playco-----	B	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
202----- Puget	D	Occasional-----	Brief-----	Nov-Apr	1.0-3.0	Apparent	Nov-May
203, 204----- Ragnar	B	None-----	---	---	>6.0	---	---
205*, 206*: Ragnar-----	B	None-----	---	---	>6.0	---	---
Lynnwood-----	A	None-----	---	---	>6.0	---	---
207----- Reggad	A	None-----	---	---	>6.0	---	---
208*: Reggad-----	A	None-----	---	---	>6.0	---	---
Haywire-----	C	None-----	---	---	>6.0	---	---
209*: Reggad-----	A	None-----	---	---	>6.0	---	---

See footnote at end of table.

TABLE 16.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
209*: Klapatche-----	C	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
210*: Reggad-----	A	None-----	---	---	>6.0	---	---
Serene-----	C	None-----	---	---	>6.0	---	---
211, 212, 213, 214----- Reichel	B	None-----	---	---	>6.0	---	---
215*----- Riverwash	D	Frequent-----	Long to very long.	Oct-Jul	0-2.0	Apparent	Jan-Dec
216, 217----- Rober	C	None-----	---	---	2.0-3.5	Perched	Dec-May
218*----- Rock outcrop	D	None-----	---	---	>6.0	---	---
219*: Rock outcrop-----	D	None-----	---	---	>6.0	---	---
Cattcreek-----	B	None-----	---	---	>6.0	---	---
220*: Rock outcrop-----	D	None-----	---	---	>6.0	---	---
Cayuse-----	B	None-----	---	---	>6.0	---	---
221*: Rock outcrop-----	D	None-----	---	---	>6.0	---	---
Haywire-----	C	None-----	---	---	>6.0	---	---
222*: Rock outcrop-----	D	None-----	---	---	>6.0	---	---
Rubble land-----	A	None-----	---	---	>6.0	---	---
Haywire-----	C	None-----	---	---	>6.0	---	---
223*: Rock outcrop-----	D	None-----	---	---	>6.0	---	---
Rubble land-----	A	None-----	---	---	>6.0	---	---
Serene-----	C	None-----	---	---	>6.0	---	---
224*----- Rubble land	A	None-----	---	---	>6.0	---	---
225----- Rugles	B	None-----	---	---	>6.0	---	---
226----- Salal	C	Occasional-----	Brief-----	Nov-Mar	3.0-4.0	Apparent	Feb-Apr

See footnote at end of table.

TABLE 16.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
227----- Sauk	B	None-----	---	---	>6.0	---	---
228, 229, 230----- Scamman	D	None-----	---	---	0.5-1.5	Perched	Nov-Apr
231----- Seattle	D	None-----	---	---	+1-0.5	Apparent	Oct-May
232, 233----- Serene	C	None-----	---	---	>6.0	---	---
234*: Serene-----	C	None-----	---	---	>6.0	---	---
Rock outcrop-----	D	None-----	---	---	>6.0	---	---
235----- Shalcar	D	None-----	---	---	+1-1.5	Apparent	Oct-May
236----- Si	C	Occasional-----	Brief-----	Feb-Apr	2.0-4.0	Apparent	Nov-Apr
237, 238----- Skykomish	B	None-----	---	---	>6.0	---	---
239----- Skykomish	B	None-----	---	---	>6.0	---	---
240----- Skykomish	B	None-----	---	---	>6.0	---	---
241, 242----- Snoqualmie	C	Occasional-----	Brief-----	Nov-Apr	3.0-5.0	Apparent	Nov-Apr
243----- Spukwush	B	None-----	---	---	>6.0	---	---
244, 245, 246----- Stahl	C	None-----	---	---	>6.0	---	---
247----- Sulsavar	B	Rare-----	---	---	>6.0	---	---
248----- Sultan	C	Rare-----	---	---	2.0-4.0	Apparent	Nov-Apr
249, 250, 251, 252, 253----- Teneriffe	A	None-----	---	---	>6.0	---	---
254, 255, 256, 257----- Tokul	C	None-----	---	---	1.5-3.0	Perched	Nov-May
258*, 259*: Tokul-----	C	None-----	---	---	1.5-3.0	Perched	Nov-May
Pastik-----	D	None-----	---	---	1.5-2.5	Perched	Dec-May
260----- Treen	D	None-----	---	---	>6.0	---	---

See footnote at end of table.

TABLE 16.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth Ft	Kind	Months
261----- Tukwila	D	None-----	---	---	+1-1.0	Apparent	Oct-May
262, 263----- Tusip	B	None-----	---	---	>6.0	---	---
264----- Typic Haploorthods	B	None-----	---	---	>6.0	---	---
265, 266----- Typic Udifluvents	B	Frequent-----	Brief-----	Dec-Apr	>6.0	---	---
267----- Udifluvents	B	Occasional-----	Brief-----	Dec-Apr	>6.0	---	---
268, 269----- Vailton	B	None-----	---	---	>6.0	---	---
270, 271, 272----- Voight	B	None-----	---	---	>6.0	---	---
273, 274----- Welcome	B	None-----	---	---	>6.0	---	---
275, 276, 277----- Wilkeson	B	None-----	---	---	>6.0	---	---
278, 279, 280----- Winston	B	None-----	---	---	>6.0	---	---
281----- Woodinville	C	Rare-----	---	---	1.5-3.0	Apparent	Oct-Apr
282----- Zynbar	B	None-----	---	---	>6.0	---	---
283----- Zynbar	B	None-----	---	---	>6.0	---	---
284----- Zynbar	C	None-----	---	---	3.0-4.0	Perched	Dec-Mar

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL FEATURES

(The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Bedrock		Cemented pan		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In		In	In			
1, 2----- Alderwood	>60	---	20-40	Thin	---	---	---	Moderate	Moderate.
3----- Alkiridge	>60	---	20-40	Thin	---	---	Moderate	Moderate	Moderate.
4, 5, 6----- Altapeak	40-60	Soft	---	---	---	---	Low-----	High-----	High.
7*: Altapeak-----	40-60	Soft	---	---	---	---	Low-----	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
8----- Andic Cryumbrepts	20-60	Hard	---	---	---	---	Moderate	Moderate	Moderate.
9----- Arents	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
10, 11, 12, 13, 14, 15, 16----- Barneston	>60	---	---	---	---	---	---	Moderate	Moderate.
17, 18, 19----- Beausite	24-40	Hard	---	---	---	---	---	Moderate	Moderate.
20----- Belfast	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
21, 22----- Bellicum	40-60	Hard	---	---	---	---	High-----	Moderate	Moderate.
23, 24----- Blethen	>60	---	---	---	---	---	---	Moderate	Moderate.
25----- Borochemists	>60	---	---	---	4-10	16-30	High-----	High-----	High.
26----- Bromo	>60	---	---	---	---	---	High-----	Moderate	Moderate.
27, 28, 29, 30----- Cattcreek	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
31----- Cattcreek	>60	---	40-60	Thin	---	---	Moderate	Moderate	Moderate.
32, 33----- Cayuse	>60	---	---	---	---	---	High-----	Moderate	Moderate.
34, 35, 36, 37, 38----- Chinkmin	>60	---	20-40	Thin	---	---	Moderate	High-----	High.

See footnote at end of table.

TABLE 17.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Cemented pan		Subsidence		Potential	Risk of corrosion	
	Depth	Hardness	Depth	Hardness	Initial	Total	frost action	Uncoated steel	Concrete
	In		In		In	In			
39, 40----- Christoff	>60	---	---	---	---	---	High-----	Moderate	Moderate.
41, 42, 43----- Chuckanut	40-60	Soft	---	---	---	---	---	Moderate	Moderate.
44, 45, 46----- Cinebar	>60	---	---	---	---	---	---	High-----	High.
47, 48----- Cotteral	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
49----- Crinker	20-40	Hard	---	---	---	---	Moderate	High-----	High.
50----- Cryofluvents	40-80	Hard	---	---	---	---	Low-----	High-----	High.
51----- Cryohemists	>60	---	---	---	---	---	High-----	High-----	High.
52----- Dobbs	>60	---	30-40	Thin	---	---	Moderate	Moderate	Moderate.
53----- Edgewick	>60	---	---	---	---	---	---	High-----	High.
54, 55----- Elwell	>60	---	20-40	Thin	---	---	High-----	High-----	High.
56, 57, 58, 59----- Ethanla	>60	---	---	---	---	---	Moderate	High-----	High.
60----- Ethanla	>60	---	40-60	Thin	---	---	Moderate	High-----	High.
61, 62----- Foss	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
63, 64, 65----- Gallup	>60	---	---	---	---	---	High-----	High-----	High.
66, 67, 68----- Getchell	>60	---	20-40	Thin	---	---	High-----	High-----	High.
69----- Greenwater	>60	---	---	---	---	---	---	Moderate	Moderate.
70----- Grotto	>60	---	---	---	---	---	Low-----	High-----	High.
71----- Hartnit	20-40	Hard	---	---	---	---	High-----	High-----	High.
72, 73, 74, 75----- Haywire	20-40	Hard	---	---	---	---	Moderate	High-----	High.
76, 77, 78----- Hinker	20-40	Hard	---	---	---	---	Moderate	High-----	High.

See footnote at end of table.

TABLE 17.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Cemented pan		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In		In	In			
79----- Humaquepts	>60	---	---	---	---	---	High-----	High-----	High.
80, 81, 82----- Index	40-70	Soft	---	---	---	---	Low-----	High-----	High.
83*: Index-----	40-70	Soft	---	---	---	---	Low-----	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
84, 85----- Jonas	40-60	Soft	---	---	---	---	High-----	Moderate	Moderate.
86, 87, 88----- Jonas	>60	---	---	---	---	---	High-----	Moderate	Moderate.
89, 90, 91----- Kaleetan	>60	---	---	---	---	---	Moderate	High-----	High.
92, 93----- Kaleetan	>60	---	40-60	Thin	---	---	Moderate	High-----	High.
94, 95----- Kaleetan	>60	---	---	---	---	---	Moderate	High-----	High.
96, 97, 98, 99----- Kanaskat	60-72	Soft	---	---	---	---	---	Moderate	Moderate.
100, 101, 102----- Kapowsin	>60	---	20-40	Thin	---	---	---	Moderate	Moderate.
103, 104, 105----- Kindy	>60	---	20-40	Thin	---	---	Moderate	High-----	High.
106----- Klaber	>60	---	---	---	---	---	---	High-----	High.
107*: Klaber-----	>60	---	---	---	---	---	---	High-----	High.
Cinebar-----	>60	---	---	---	---	---	---	High-----	High.
108, 109----- Klapatche	30-40	Hard	---	---	---	---	Low-----	High-----	High.
110*: Klapatche-----	30-40	Hard	---	---	---	---	Low-----	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
111, 112, 113, 114, 115- Klaus	>60	---	20-40	Thin	---	---	---	High-----	High.
116, 117----- Larrupin	>60	---	---	---	---	---	High-----	Moderate	Low.
118----- Larrupin	>60	---	40-60	Thin	---	---	Moderate	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Cemented pan		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In		In	In			
119----- Lemolo	>60	---	---	---	---	---	---	High-----	High.
120, 121, 122, 123, 124, 125----- Littlejohn	25-40	Hard	---	---	---	---	Moderate	Moderate	Moderate.
126*: Littlejohn-----	25-40	Hard	---	---	---	---	Moderate	Moderate	Moderate.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
127----- Lynnwood	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
128, 129, 130----- Marblemount	20-40	Soft	---	---	---	---	Low-----	Moderate	Moderate.
131*: Marblemount-----	20-40	Soft	---	---	---	---	Low-----	Moderate	Moderate.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
132, 133----- Mashel	>60	---	---	---	---	---	---	High-----	High.
134, 135, 136, 137----- Melakwa	20-40	Hard	---	---	---	---	Moderate	High-----	High.
138*: Melakwa-----	20-40	Hard	---	---	---	---	Moderate	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
139----- Mowich	>60	---	---	---	---	---	Moderate	High-----	High.
140----- Mukilteo	>60	---	---	---	4-12	>60	---	High-----	High.
141, 142----- Nagrom	20-40	Hard	---	---	---	---	Moderate	High-----	High.
143, 144----- Nagrom	20-40	Soft	---	---	---	---	Moderate	High-----	High.
145*: Nagrom-----	20-40	Hard	---	---	---	---	Moderate	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
146, 147----- Nargar	>60	---	---	---	---	---	---	Moderate	Moderate.
148*: Nargar-----	>60	---	---	---	---	---	---	Moderate	Moderate.
Pastik-----	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
149----- National	>60	---	---	---	---	---	---	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Cemented pan		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In		In	In			
150----- Neilton	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
151, 152, 153, 154, 155- Nimue	>60	---	---	---	---	---	Moderate	High-----	High.
156*: Nimue-----	>60	---	---	---	---	---	Moderate	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
157----- Nooksack	>60	---	---	---	---	---	---	Moderate	Low.
158----- Norma	>60	---	---	---	---	---	---	Moderate	Moderate.
159----- Oakes	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
160, 161----- Oakes	>60	---	40-60	Thin	---	---	Moderate	Moderate	Moderate.
162, 163----- Ogarty	20-40	Hard	---	---	---	---	---	High-----	High.
164*: Ogarty-----	20-40	Hard	---	---	---	---	---	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
165, 166----- Ohop	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
167, 168----- Olomount	20-40	Hard	---	---	---	---	Moderate	Moderate	Moderate.
169*: Olomount-----	20-40	Hard	---	---	---	---	Moderate	Moderate	Moderate.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
170----- Oridia	>60	---	---	---	---	---	---	High-----	High.
171*: Orthents-----	20-80	Hard	---	---	---	---	Low-----	Moderate	Moderate.
Humods-----	20-60	Hard	---	---	---	---	Low-----	Moderate	Moderate.
172, 173----- Ovall	20-40	Hard	---	---	---	---	---	Moderate	Moderate.
174----- Pastik	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
175, 176----- Persis	>60	---	---	---	---	---	---	High-----	High.

See footnote at end of table.

TABLE 17.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Cemented pan		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In		In	In			
177, 178----- Pheeney	20-40	Hard	---	---	---	---	Moderate	Moderate	Moderate.
179, 180----- Pheeney	20-40	Soft	---	---	---	---	Moderate	Moderate	Moderate.
181*: Pheeney-----	20-40	Hard	---	---	---	---	Moderate	Moderate	Moderate.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
182, 183----- Philippa	>60	---	20-40	Thin	---	---	Moderate	High-----	High.
184----- Pierking	>60	---	---	---	---	---	High-----	Moderate	Moderate.
185*: Pierking-----	>60	---	---	---	---	---	High-----	Moderate	Moderate.
Borochemists-----	>60	---	---	---	4-10	16-30	High-----	High-----	High.
186*: Pierking-----	>60	---	---	---	---	---	High-----	Moderate	Moderate.
Mowich-----	>60	---	---	---	---	---	Moderate	High-----	High.
187----- Pilchuck	>60	---	---	---	---	---	---	Moderate	Moderate.
188, 189, 190, 191, 192, 193----- Pitcher	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
194*: Pitcher-----	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
195*----- Pits	>60	---	---	---	---	---	---	---	---
196, 197, 198, 199, 200- Playco	>60	---	---	---	---	---	Moderate	High-----	High.
201*: Playco-----	>60	---	---	---	---	---	Moderate	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
202----- Puget	>60	---	---	---	---	---	---	High-----	High.
203, 204----- Ragnar	>60	---	---	---	---	---	---	Moderate	Moderate.
205*, 206*: Ragnar-----	>60	---	---	---	---	---	---	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Cemented pan		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In		In	In			
205*, 206*: Lynnwood-----	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
207----- Reggad	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
208*: Reggad-----	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
Haywire-----	20-40	Hard	---	---	---	---	Moderate	High-----	High.
209*: Reggad-----	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
Klapatche-----	30-40	Hard	---	---	---	---	Low-----	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
210*: Reggad-----	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
Serene-----	20-40	Soft	---	---	---	---	Low-----	High-----	High.
211, 212----- Reichel	40-60	Hard	---	---	---	---	High-----	High-----	High.
213, 214----- Reichel	40-80	Soft	---	---	---	---	High-----	High-----	High.
215*----- Riverwash	>60	---	---	---	---	---	---	---	---
216, 217----- Rober	>60	---	---	---	---	---	High-----	Moderate	Moderate.
218*----- Rock outcrop	0	Hard	---	---	---	---	---	---	---
219*: Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
Cattcreek-----	40-60	Hard	---	---	---	---	Moderate	Moderate	Moderate.
220*: Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
Cayuse-----	>60	---	---	---	---	---	High-----	Moderate	Moderate.
221*: Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
Haywire-----	20-40	Hard	---	---	---	---	Moderate	High-----	High.
222*: Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
Rubble land-----	>40	Hard	---	---	---	---	---	---	---
Haywire-----	20-40	Hard	---	---	---	---	Moderate	High-----	High.

See footnote at end of table.

TABLE 17.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Cemented pan		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In		In	In			
223*: Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
Rubble land-----	>40	Hard	---	---	---	---	---	---	---
Serene-----	20-40	Soft	---	---	---	---	Low-----	High-----	High.
224*----- Rubble land	>40	Hard	---	---	---	---	---	---	---
225----- Rugles	>60	---	---	---	---	---	High-----	Moderate	Moderate.
226----- Salal	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
227----- Sauk	>60	---	---	---	---	---	---	Moderate	Moderate.
228, 229, 230----- Scamman	>60	---	---	---	---	---	---	Moderate	Moderate.
231----- Seattle	>60	---	---	---	6-20	>50	---	High-----	High.
232, 233----- Serene	20-40	Soft	---	---	---	---	Low-----	High-----	High.
234*: Serene-----	20-40	Soft	---	---	---	---	Low-----	High-----	High.
Rock outcrop-----	0	Hard	---	---	---	---	---	---	---
235----- Shalcar	>60	---	---	---	6-10	16-51	---	High-----	High.
236----- Si	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
237, 238----- Skykomish	>60	---	---	---	---	---	Low-----	High-----	High.
239----- Skykomish	>60	---	---	---	---	---	Low-----	High-----	High.
240----- Skykomish	>60	---	---	---	---	---	Low-----	High-----	High.
241, 242----- Snoqualmie	>60	---	---	---	---	---	---	Moderate	Moderate.
243----- Spukwush	>60	---	---	---	---	---	High-----	Moderate	Moderate.
244, 245, 246----- Stahl	20-40	Hard	---	---	---	---	Moderate	Moderate	Moderate.
247----- Sulsavar	>60	---	---	---	---	---	---	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL FEATURES--Continued

Soil name and map symbol	Bedrock		Cemented pan		Subsidence		Potential	Risk of corrosion	
	Depth	Hardness	Depth	Hardness	Initial	Total	frost action	Uncoated steel	Concrete
	In		In		In	In			
248----- Sultan	>60	---	---	---	---	---	---	High-----	High.
249, 250----- Teneriffe	>60	---	---	---	---	---	---	Moderate	Moderate.
251, 252, 253----- Teneriffe	40-60	Soft	---	---	---	---	---	Moderate	Moderate.
254, 255, 256, 257----- Tokul	>60	---	20-40	Thin	---	---	---	Moderate	Moderate.
258*, 259*: Tokul-----	>60	---	20-40	Thin	---	---	---	Moderate	Moderate.
Pastik-----	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
260----- Treen	10-20	Hard	---	---	---	---	High-----	Moderate	High.
261----- Tukwila	>60	---	---	---	6-12	>60	---	High-----	High.
262, 263----- Tusip	40-60	Soft	---	---	---	---	High-----	Moderate	Moderate.
264----- Typic Haplorthods	>60	---	20-60	Thin	---	---	---	Moderate	Moderate.
265, 266----- Typic Udifluvents	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
267----- Udifluvents	>60	---	---	---	---	---	Low-----	Moderate	Moderate.
268, 269----- Vailton	40-60	Soft	---	---	---	---	High-----	Moderate	Moderate.
270, 271, 272----- Voight	>60	---	---	---	---	---	Moderate	Moderate	Moderate.
273, 274----- Welcome	40-60	Soft	---	---	---	---	High-----	Moderate	Moderate.
275, 276, 277----- Wilkeson	>60	---	---	---	---	---	---	Moderate	Moderate.
278, 279, 280----- Winston	>60	---	---	---	---	---	---	Moderate	Moderate.
281----- Woodinville	>60	---	---	---	3-6	24-33	---	High-----	High.
282----- Zynbar	>60	---	---	---	---	---	High-----	Moderate	Moderate.
283----- Zynbar	>60	---	---	---	---	---	High-----	Moderate	Moderate.
284----- Zynbar	>60	---	---	---	---	---	High-----	Moderate	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alderwood-----	Loamy-skeletal, mixed, mesic, ortstein Aquic Haplorthods
Alkridge-----	Ashy over loamy-skeletal, mixed Typic Cryorthods
Altapeak-----	Sandy-skeletal, mixed Typic Cryorthods
Andic Cryumbrepts-----	Andic Cryumbrepts
Arents-----	Arents
Barneston-----	Sandy-skeletal, mixed, mesic Typic Haplorthods
Beausite-----	Loamy-skeletal, mixed, mesic Typic Haplorthods
Belfast-----	Coarse-loamy, mixed, nonacid, mesic Aquic Xerofluvents
Bellicum-----	Cindery over medial-skeletal, frigid Typic Haplorthods
Blethen-----	Loamy-skeletal, mixed, mesic Typic Haplorthods
Borohemists-----	Borohemists
Bromo-----	Cindery over medial, frigid Typic Haplorthods
Cattcreek-----	Cindery over medial-skeletal Typic Cryorthods
Cayuse-----	Ashy over medial Typic Cryandeps
Chinkmin-----	Loamy-skeletal, mixed, ortstein Typic Cryohumods
Christoff-----	Fine-loamy, mixed Eutric Glossoboralfs
Chuckanut-----	Coarse-loamy, mixed, mesic Typic Haplorthods
Cinebar-----	Medial, mesic Typic Dystrandeps
Cotteral-----	Cindery over medial Typic Cryorthods
Crinker-----	Loamy-skeletal, mixed Typic Cryorthods
Cryofluvents-----	Cryofluvents
Cryohemists-----	Cryohemists
Dobbs-----	Medial-skeletal, frigid Andic Haplumbrepts
Edgewick-----	Coarse-loamy, mixed, mesic Fluventic Haplumbrepts
Elwell-----	Coarse-loamy, mixed, frigid, ortstein Typic Haplorthods
Ethania-----	Cindery over medial-skeletal Typic Cryohumods
Foss-----	Medial over loamy-skeletal, mixed Typic Cryorthods
Gallup-----	Coarse-loamy, mixed Humic Cryorthods
Getchell-----	Coarse-loamy, mixed, ortstein Typic Cryorthods
Greenwater-----	Mixed, mesic Dystric Xeropsamments
Grotto-----	Sandy-skeletal, mixed, frigid Typic Haplorthods
Hartnit-----	Coarse-loamy, mixed Typic Cryorthods
Haywire-----	Loamy-skeletal, mixed Typic Cryohumods
Hinker-----	Loamy-skeletal, mixed Humic Cryorthods
Humaquepts-----	Humaquepts
Humods-----	Humods
Index-----	Sandy-skeletal, mixed Haplic Cryohumods
Jonas-----	Medial, frigid Andic Haplumbrepts
Kaleetan-----	Loamy-skeletal, mixed, frigid Typic Haplohumods
Kanaskat-----	Loamy-skeletal, mixed, mesic Typic Haplorthods
Kapowsin-----	Coarse-loamy, mixed, mesic, ortstein Aquic Haplorthods
Kindy-----	Loamy-skeletal, mixed, ortstein Typic Cryorthods
Klaber-----	Fine, mixed, mesic Typic Glossaqualfs
Klapatche-----	Sandy-skeletal, mixed Haplic Cryohumods
Klaus-----	Sandy-skeletal, mixed, mesic, ortstein Typic Haplorthods
Larrupin-----	Loamy-skeletal, mixed, frigid Typic Haplorthods
Lemolo-----	Loamy-skeletal, mixed, nonacid, mesic Typic Humaquepts
Littlejohn-----	Loamy-skeletal, mixed, frigid Typic Haplorthods
Lynnwood-----	Sandy, mixed, mesic Entic Haplorthods
Marblemount-----	Sandy-skeletal, mixed, frigid Typic Haplorthods
Mashel-----	Fine, halloysitic, mesic Ultic Haploxeralfs
Melakwa-----	Loamy-skeletal, mixed, frigid Typic Haplohumods
Mowich-----	Coarse-silty over clayey, mixed, frigid Aquic Haplorthods
Mukilteo-----	Dysic, mesic Typic Medihemists
Nagrom-----	Loamy-skeletal, mixed Haplic Cryohumods
Nargar-----	Sandy, mixed, mesic Typic Haplorthods
National-----	Cindery over medial, mesic Umbric Vitrandeps
Neilton-----	Sandy-skeletal, mixed, mesic Dystric Xerorthents
Nimue-----	Loamy-skeletal, mixed Haplic Cryohumods
Nooksack-----	Coarse-silty, mixed, mesic Fluventic Haploxerolls
Norma-----	Coarse-loamy, mixed, nonacid, mesic Mollic Haplaquepts
Oakes-----	Loamy-skeletal, mixed, frigid Typic Haplorthods

TABLE 18.--CLASSIFICATION OF THE SOILS--Continued

Soil name	Family or higher taxonomic class
Ogarty-----	Loamy-skeletal, mixed, mesic Typic Haplorthods
Ohop-----	Loamy-skeletal, mixed, frigid Aquic Dystrochrepts
Olomount-----	Loamy-skeletal, mixed, frigid Typic Haplorthods
Oridia-----	Coarse-silty, mixed, nonacid, mesic Aeris Fluvaquents
Orthents-----	Orthents
Ovall-----	Loamy-skeletal, mixed, mesic Typic Xerumbrepts
Pastik-----	Coarse-silty, mixed, mesic Aquic Haplorthods
Persis-----	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Humic Haplorthods
Pheeney-----	Medial-skeletal, frigid Andic Xerumbrepts
Philippa-----	Loamy-skeletal, mixed, frigid, ortstein Humic Haplorthods
Pierking-----	Loamy-skeletal, mixed, nonacid, frigid Typic Haplaquepts
Pilchuck-----	Mixed, mesic Dystric Xeropsamments
Pitcher-----	Loamy-skeletal, mixed, frigid Typic Haplorthods
Playco-----	Loamy-skeletal, mixed Haplic Cryohumods
Puget-----	Fine-silty, mixed, nonacid, mesic Aeris Fluvaquents
Ragnar-----	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplorthods
Reggad-----	Dysic Typic Cryofolists
Reichel-----	Medial Andic Cryumbrepts
Rober-----	Coarse-silty, mixed, frigid Aquic Haplorthods
Rugles-----	Medial, frigid Entic Dystrandepts
Salal-----	Coarse-silty, mixed, mesic Cumulic Haplumbrepts
Sauk-----	Coarse-loamy, mixed, mesic Typic Haplorthods
Scamman-----	Fine, mixed, mesic Aquic Palexeralfs
Seattle-----	Euic, mesic Hemic Medisaprists
Serene-----	Sandy-skeletal, mixed Humic Cryorthods
Shalcar-----	Loamy, mixed, euic, mesic Terric Medisaprists
Si-----	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Skykomish-----	Sandy-skeletal, mixed, frigid Typic Haplorthods
Snoqualmie-----	Sandy-skeletal, mixed, mesic Dystric Xerorthents
Spukwush-----	Ashy over loamy, mixed Typic Cryorthods
Stahl-----	Medial-skeletal Andic Cryumbrepts
Sulsavar-----	Coarse-loamy, mixed, mesic Typic Haplorthods
Sultan-----	Fine-silty, mixed, nonacid, mesic Aquic Xerofluvents
Teneriffe-----	Sandy-skeletal, mixed, frigid Typic Haplorthods
Tokul-----	Coarse-loamy, mixed, mesic, ortstein Typic Haplorthods
Treen-----	Medial Lithic Cryandepts
Tukwila-----	Diatomaceous, dysic, mesic Limnic Medisaprists
Tusip-----	Ashy over loamy, mixed Typic Cryorthods
Typic Haplorthods-----	Typic Haplorthods
Typic Udifluvents-----	Typic Udifluvents
Udifluvents-----	Udifluvents
Vailton-----	Medial, frigid Andic Haplumbrepts
Voight-----	Fine-loamy, mixed Eutric Glossoboralfs
Welcome-----	Coarse-loamy, mixed, frigid Typic Haplorthods
Wilkeson-----	Fine-loamy, mixed, mesic Ultic Haploxeralfs
Winston-----	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplorthods
Woodinville-----	Fine-silty, mixed, nonacid, mesic Aeris Fluvaquents
Zynbar-----	Medial, frigid Entic Dystrandepts

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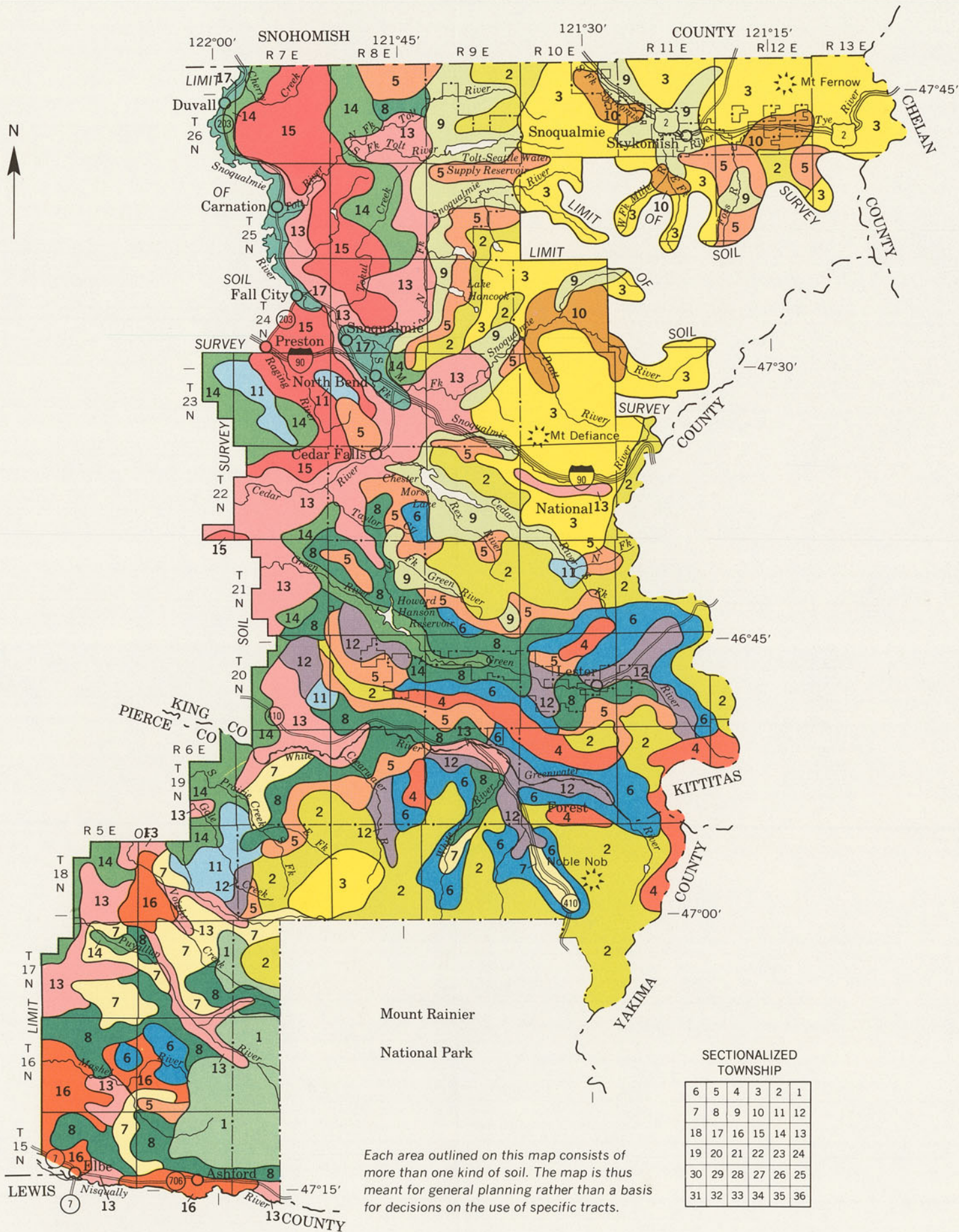
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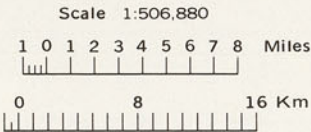


LEGEND

- SOILS ON HIGH MOUNTAINS
- 1 ETHANIA-CATTCREEK: Very deep, well drained, gently sloping to very steep soils on mountain ridge crests and back slopes and in cirque basins
 - 2 NIMUE-HAYWIRE-CHINKMIN: Moderately deep and very deep, well drained and moderately well drained, nearly level to very steep soils on ridgetops, mountainsides, and mountain back slopes, in cirque basins and valleys and on lateral moraines and drift plains
 - 3 REGGAD-ALTAPEAK-INDEX: Deep and very deep, well drained and excessively drained, gently sloping to very steep soils on mountain slopes and back slopes
 - 4 NIMUE: Very deep, well drained, gently sloping to very steep soils on ridgetops and mountain back slopes
 - 5 PLAYCO-NAGROM: Moderately deep and very deep, well drained, gently sloping to very steep soils on ridge crests and mountain back slopes
 - 6 PLAYCO: Very deep, well drained, gently sloping to very steep soils on mountain back slopes
- SOILS ON LOW MOUNTAINS
- 7 ZYNBAR: Deep and very deep, well drained, nearly level to very steep soils on mountain back slopes
 - 8 PITCHER-JONAS-OAKES: Deep and very deep, well drained, gently sloping to very steep soils on mountain back slopes and toe slopes
 - 9 KALEETAN-MELAKWA: Moderately deep and very deep, well drained, gently sloping to very steep soils on mountain back slopes and toe slopes
 - 10 TENERIFFE-MARBLEMOUNT: Moderately deep to very deep, well drained, gently sloping to very steep soils on mountain back slopes
 - 11 ELWELL-PHILIPPA: Moderately deep, moderately well drained, nearly level to very steep soils on mountain back slopes, on plateaus, in cirques, and on lateral moraines
 - 12 PITCHER: Very deep, well drained, gently sloping to very steep soils on mountain back slopes
- SOILS ON TERRACES, FOOTHILLS,, AND TILL PLAINS
- 13 BARNESTON-KLAUS-SKYKOMISH: Moderately deep and very deep, somewhat excessively drained and well drained, nearly level to very steep soils on terraces and terrace escarpments
 - 14 TOKUL-BLETHAN-OGARTY: Moderately deep and very deep, moderately well drained and well drained, nearly level to very steep soils in valleys and on mountain foot slopes, back slopes, side slopes, toe slopes, and drift plain escarpments
 - 15 TOKUL: Moderately deep, moderately well drained, nearly level to very steep soils on mountain foot slopes and in valleys
 - 16 MASHIEL-SCAMMAN-NATIONAL: Very deep, moderately well drained, somewhat poorly drained, and well drained, nearly level to very steep soils on terraces and foothill back slopes
- SOILS ON FLOOD PLAINS, TERRACES, AND TILL PLAINS AND IN RIVER VALLEYS
- 17 EDGEWICK-SEATTLE-NOOKSACK: Very deep, well drained, moderately well drained, and very poorly drained, nearly level soils on river terraces, on flood plains, in river valleys, and on glacial till plains

Compiled 1991

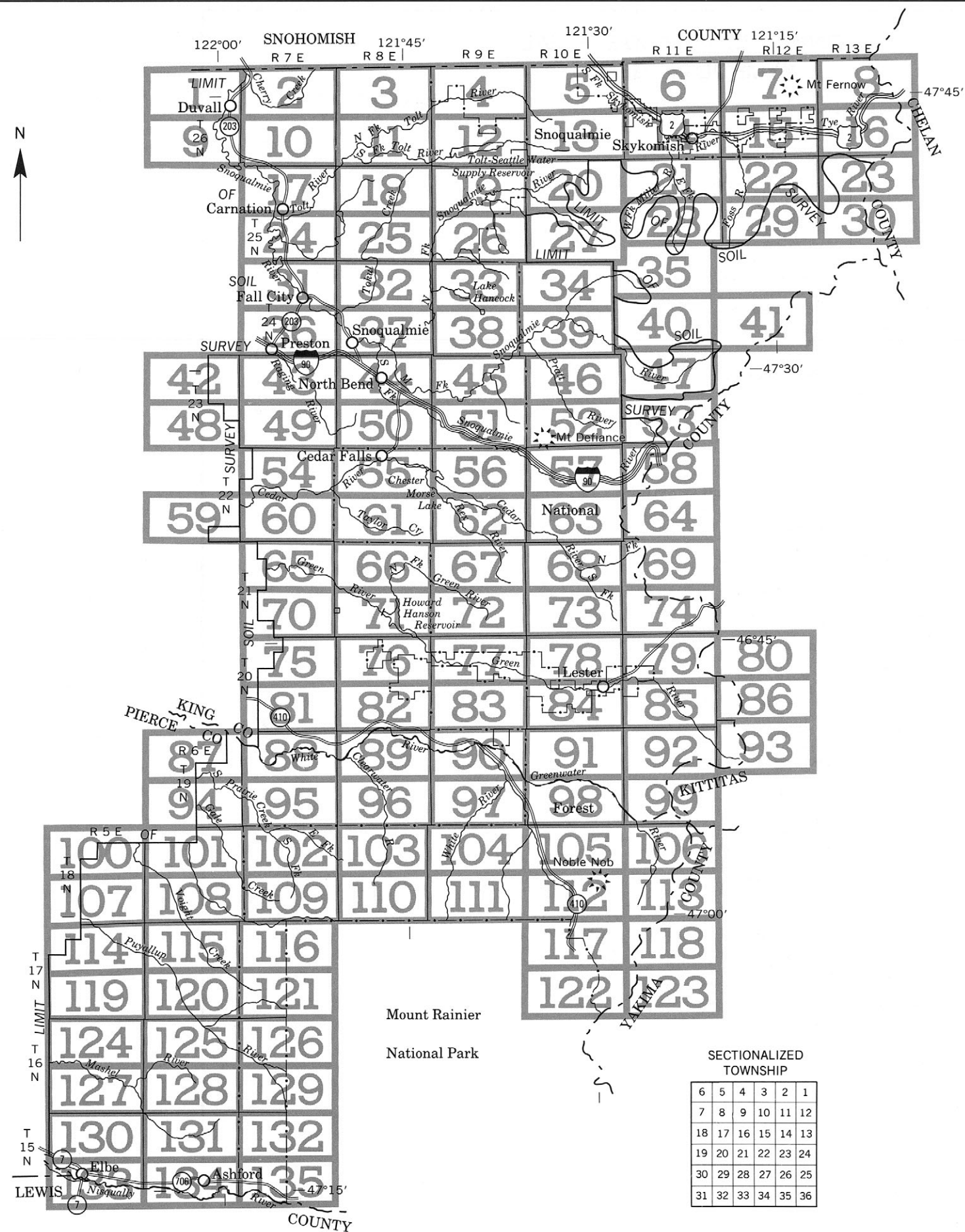
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
WASHINGTON DEPARTMENT OF NATURAL RESOURCES
WASHINGTON STATE UNIVERSITY AGRICULTURAL RESEARCH CENTER
GENERAL SOIL MAP
SNOQUALMIE PASS AREA
PARTS OF KING AND PIERCE COUNTIES
WASHINGTON



Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

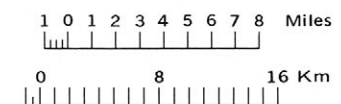
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



Original text from each individual map sheet read:
 Coordinate grid ticks and land division corners, if shown, are approximately positioned. Base maps are orthophotographs prepared by the State of Washington, Department of Natural Resources, from 1974 and 1975 aerial photography. This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

INDEX TO MAP SHEETS SNOQUALMIE PASS AREA PARTS OF KING AND PIERCE COUNTIES WASHINGTON

Scale 1:506,880



SOIL LEGEND

SYMBOL	NAME	SYMBOL	NAME
1	Alderwood gravelly loam, 6 to 15 percent slopes	97	Kanaskat gravelly sandy loam, 30 to 65 percent slopes
2	Alderwood gravelly loam, 15 to 30 percent slopes	98	Kanaskat gravelly sandy loam, tuff substratum, 8 to 30 percent slopes
3	Alkridge sandy loam, 8 to 30 percent slopes	99	Kanaskat gravelly sandy loam, tuff substratum, 30 to 65 percent slopes
4	Altapeak gravelly sandy loam, 8 to 30 percent slopes	100	Kapowsin gravelly loam, 6 to 15 percent slopes
5	Altapeak gravelly sandy loam, 30 to 65 percent slopes	101	Kapowsin gravelly loam, 15 to 30 percent slopes
6	Altapeak gravelly sandy loam, 65 to 90 percent slopes	102	Kapowsin gravelly loam, 30 to 65 percent slopes
7	Altapeak-Rock outcrop complex, 45 to 90 percent slopes	103	Kindy gravelly loam, 0 to 15 percent slopes
8	Andic Cryumbrepts, 30 to 90 percent slopes	104	Kindy gravelly loam, 15 to 30 percent slopes
9	Arents, 0 to 8 percent slopes	105	Kindy gravelly loam, 30 to 65 percent slopes
10	Barneston gravelly coarse sandy loam, 0 to 6 percent slopes	106	Klaber silt loam, 0 to 8 percent slopes
11	Barneston gravelly coarse sandy loam, 6 to 30 percent slopes	107	Klaber-Cinebar silt loams, 0 to 8 percent slopes
12	Barneston gravelly coarse sandy loam, 30 to 65 percent slopes	108	Klapatche loamy sand, 8 to 30 percent slopes
13	Barneston gravelly sandy loam, 0 to 8 percent slopes	109	Klapatche loamy sand, 30 to 65 percent slopes
14	Barneston gravelly sandy loam, 8 to 30 percent slopes	110	Klapatche-Rock outcrop complex, 45 to 90 percent slopes
15	Barneston gravelly sandy loam, 30 to 65 percent slopes	111	Klaus sandy loam, 0 to 8 percent slopes
16	Barneston gravelly sandy loam, windswept, 6 to 30 percent slopes	112	Klaus sandy loam, 8 to 15 percent slopes
17	Beausite gravelly loam, 6 to 30 percent slopes	113	Klaus sandy loam, 30 to 65 percent slopes
18	Beausite gravelly loam, 30 to 65 percent slopes	114	Klaus sandy loam, windswept, 0 to 8 percent slopes
19	Beausite gravelly loam, 65 to 90 percent slopes	115	Klaus sandy loam, windswept, 30 to 65 percent slopes
20	Belfast silt loam, 0 to 2 percent slopes	116	Larrupin loamy sand, 3 to 30 percent slopes
21	Bellicum very cindery loamy sand, 8 to 30 percent slopes	117	Larrupin loamy sand, 30 to 65 percent slopes
22	Bellicum very cindery loamy sand, 30 to 65 percent slopes	118	Larrupin loamy sand, hard substratum, 6 to 30 percent slopes
23	Blethen gravelly loam, 5 to 30 percent slopes	119	Littlejohn gravelly sandy loam, 8 to 30 percent slopes
24	Blethen gravelly loam, 30 to 65 percent slopes	120	Littlejohn gravelly sandy loam, 30 to 65 percent slopes
25	Borohemists, 0 to 2 percent slopes	121	Littlejohn gravelly sandy loam, windswept, 30 to 65 percent slopes
26	Bromo very cindery sandy loam, 30 to 65 percent slopes	122	Littlejohn gravelly sandy loam, tuff substratum, 8 to 30 percent slopes
27	Cattcreek very cindery loamy sand, 30 to 65 percent slopes	123	Littlejohn gravelly sandy loam, tuff substratum, 30 to 65 percent slopes
28	Cattcreek very cindery loamy sand, 65 to 90 percent slopes	124	Littlejohn gravelly sandy loam, tuff substratum, windswept, 30 to 65 percent slopes
29	Cattcreek very cindery loamy sand, sandstone substratum, 30 to 65 percent slopes	125	Littlejohn-Rock outcrop complex, 30 to 90 percent slopes
30	Cattcreek very cindery loamy sand, sandstone substratum, 65 to 90 percent slopes	126	Lynnwood loamy fine sand, 6 to 15 percent slopes
31	Cattcreek very cindery loamy sand, till substratum, 8 to 30 percent slopes	127	Marblemount gravelly loamy sand, 8 to 30 percent slopes
32	Cayuse sandy loam, 8 to 30 percent slopes	128	Marblemount gravelly loamy sand, 30 to 65 percent slopes
33	Cayuse sandy loam, 30 to 65 percent slopes	129	Marblemount gravelly loamy sand, schist substratum, 30 to 65 percent slopes
34	Chinkmin sandy loam, 0 to 15 percent slopes	130	Marblemount-Rock outcrop complex, 45 to 90 percent slopes
35	Chinkmin sandy loam, 15 to 30 percent slopes	131	Mashel silt loam, 5 to 30 percent slopes
36	Chinkmin sandy loam, 30 to 65 percent slopes	132	Mashel silt loam, 30 to 65 percent slopes
37	Chinkmin sandy loam, cold, 0 to 15 percent slopes	133	Mashel silt loam, 8 to 30 percent slopes
38	Chinkmin sandy loam, cold, 15 to 30 percent slopes	134	Melakwa sandy loam, 30 to 65 percent slopes
39	Christoff sandy loam, 6 to 30 percent slopes	135	Melakwa sandy loam, windswept, 30 to 65 percent slopes
40	Christoff sandy loam, 30 to 65 percent slopes	136	Melakwa sandy loam, tuff substratum, 30 to 65 percent slopes
41	Chuckanut loam, 6 to 15 percent slopes	137	Melakwa-Rock outcrop complex, 45 to 90 percent slopes
42	Chuckanut loam, 15 to 30 percent slopes	138	Mowich silt loam, 0 to 15 percent slopes
43	Chuckanut loam, 30 to 65 percent slopes	139	Mukilteo peat, 0 to 1 percent slopes
44	Cinebar silt loam, 6 to 15 percent slopes	140	Nagrom sandy loam, 8 to 30 percent slopes
45	Cinebar silt loam, 15 to 30 percent slopes	141	Nagrom sandy loam, 30 to 65 percent slopes
46	Cinebar silt loam, 30 to 45 percent slopes	142	Nagrom gravelly loam, tuff substratum, 8 to 30 percent slopes
47	Cottler very cindery sandy loam, 8 to 30 percent slopes	143	Nagrom gravelly loam, tuff substratum, 30 to 65 percent slopes
48	Cottler very cindery sandy loam, cold, 30 to 65 percent slopes	144	Nagrom-Rock outcrop complex, 30 to 90 percent slopes
49	Crinker very channery loam, 30 to 65 percent slopes	145	Nargar fine sandy loam, 0 to 15 percent slopes
50	Cryofluvents, 0 to 8 percent slopes	146	Nargar fine sandy loam, 15 to 30 percent slopes
51	Cryohemists, 0 to 2 percent slopes	147	Nargar-Pastik complex, 35 to 70 percent slopes
52	Dobbs loam, 8 to 30 percent slopes	148	National cindery sandy loam, 0 to 8 percent slopes
53	Edgewick silt loam, 0 to 3 percent slopes	149	Neilton gravelly loamy sand, 2 to 15 percent slopes
54	Elwell silt loam, 6 to 30 percent slopes	150	Nimue loamy sand, 6 to 30 percent slopes
55	Elwell silt loam, 30 to 65 percent slopes	151	Nimue loamy sand, 30 to 65 percent slopes
56	Ethania very cindery loamy sand, 30 to 65 percent slopes	152	Nimue loamy sand, 65 to 90 percent slopes
57	Ethania very cindery loamy sand, 65 to 90 percent slopes	153	Nimue loamy sand, tuff substratum, 8 to 30 percent slopes
58	Ethania very cindery loamy sand, sandstone substratum, 30 to 65 percent slopes	154	Nimue loamy sand, tuff substratum, 30 to 65 percent slopes
59	Ethania very cindery loamy sand, sandstone substratum, 65 to 90 percent slopes	155	Nimue-Rock outcrop complex, 30 to 90 percent slopes
60	Ethania very cindery loamy sand, till substratum, 8 to 30 percent slopes	156	Nooksack silt loam, 0 to 2 percent slopes
61	Foss stony sandy loam, 8 to 30 percent slopes	157	Norma loam, 0 to 3 percent slopes
62	Foss stony sandy loam, 30 to 65 percent slopes	158	Oakes gravelly loam, 6 to 30 percent slopes
63	Gallup loam, 6 to 30 percent slopes	159	Oakes cobbly loam, 6 to 30 percent slopes
64	Gallup loam, 30 to 65 percent slopes	160	Oakes cobbly loam, 30 to 65 percent slopes
65	Gallup loam, breccia substratum, 30 to 65 percent slopes	161	Ogarty gravelly loam, 8 to 30 percent slopes
66	Getchell loam, 6 to 15 percent slopes	162	Ogarty gravelly loam, 30 to 65 percent slopes
67	Getchell loam, 15 to 30 percent slopes	163	Ogarty-Rock outcrop complex, 45 to 90 percent slopes
68	Getchell loam, 30 to 65 percent slopes	164	Ohop sandy loam, 0 to 8 percent slopes
69	Greenwater loamy sand, 0 to 8 percent slopes	165	Ohop very gravelly loam, 0 to 15 percent slopes
70	Grotto gravelly loamy sand, 0 to 8 percent slopes	166	Olomount gravelly loam, 8 to 30 percent slopes
71	Hartnit silt loam, 8 to 30 percent slopes	167	Olomount gravelly loam, 30 to 65 percent slopes
72	Haywire sandy loam, 8 to 30 percent slopes	168	Olomount-Rock outcrop complex, 45 to 90 percent slopes
73	Haywire sandy loam, 30 to 65 percent slopes	169	Oridia silt loam, 0 to 2 percent slopes
74	Haywire loamy sand, tuff substratum, 8 to 30 percent slopes	170	Orthents, avalanche chutes-Humods complex, 30 to 100 percent slopes
75	Haywire loamy sand, tuff substratum, 30 to 65 percent slopes	171	Ovall gravelly loam, 15 to 30 percent slopes
76	Hinker gravelly sandy loam, 8 to 30 percent slopes	172	Ovall gravelly loam, 30 to 65 percent slopes
77	Hinker gravelly sandy loam, 30 to 65 percent slopes	173	Pastik silt loam, 0 to 30 percent slopes
78	Hinker gravelly sandy loam, 65 to 90 percent slopes	174	Pastik silt loam, 30 to 65 percent slopes
79	Humaquepts, 0 to 5 percent slopes	175	Persis sandy loam, 0 to 8 percent slopes
80	Index loamy sand, 8 to 30 percent slopes	176	Persis sandy loam, windswept, 0 to 8 percent slopes
81	Index loamy sand, 30 to 65 percent slopes	177	Pheeneey gravelly loam, 8 to 30 percent slopes
82	Index loamy sand, 65 to 90 percent slopes	178	Pheeneey gravelly loam, 30 to 65 percent slopes
83	Index-Rock outcrop complex, 45 to 90 percent slopes	179	Pheeneey gravelly silt loam, tuff substratum, 8 to 30 percent slopes
84	Jonas gravelly loam, tuff substratum, 15 to 30 percent slopes	180	Pheeneey gravelly silt loam, tuff substratum, 30 to 65 percent slopes
85	Jonas gravelly loam, tuff substratum, 30 to 65 percent slopes	181	Pheeneey-Rock outcrop complex, 30 to 90 percent slopes
86	Jonas gravelly silt loam, 15 to 30 percent slopes	182	Philippa sandy loam, 0 to 30 percent slopes
87	Jonas gravelly silt loam, 30 to 65 percent slopes	183	Philippa sandy loam, 30 to 65 percent slopes
88	Jonas gravelly silt loam, 65 to 90 percent slopes	184	Pierking gravelly sandy loam, 0 to 3 percent slopes
89	Kaleetan sandy loam, 8 to 30 percent slopes	185	Pierking-Borohemists complex, 0 to 5 percent slopes
90	Kaleetan sandy loam, 30 to 65 percent slopes	186	Pierking-Mowich complex, 2 to 15 percent slopes
91	Kaleetan sandy loam, windswept, 30 to 65 percent slopes	187	Pitcher sandy loam, 8 to 30 percent slopes
92	Kaleetan sandy loam, till substratum, 8 to 30 percent slopes	188	Pitcher sandy loam, 30 to 65 percent slopes
93	Kaleetan sandy loam, till substratum, 30 to 65 percent slopes	189	Pitcher sandy loam, windswept, 30 to 65 percent slopes
94	Kaleetan sandy loam, tuff substratum, 8 to 30 percent slopes	190	Pitcher sandy loam, tuff substratum, 8 to 30 percent slopes
95	Kaleetan sandy loam, tuff substratum, 30 to 65 percent slopes	191	Pitcher sandy loam, tuff substratum, 30 to 65 percent slopes
96	Kanaskat gravelly sandy loam, 0 to 30 percent slopes	192	Pitcher sandy loam, tuff substratum, 30 to 65 percent slopes

SYMBOL	NAME	SYMBOL	NAME
193	Pitcher sandy loam, tuff substratum, windswept, 30 to 65 percent slopes	240	Skykomish very stony loam, 0 to 30 percent slopes
194	Pitcher-Rock outcrop complex, 30 to 90 percent slopes	241	Snoqualmie loamy fine sand, 0 to 8 percent slopes
195	Pits	242	Snoqualmie loamy fine sand, windswept, 0 to 8 percent slopes
196	Playco loamy sand, 8 to 30 percent slopes	243	Spukwush loamy sand, 8 to 30 percent slopes
197	Playco loamy sand, 30 to 65 percent slopes	244	Stahl very gravelly silt loam, 30 to 65 percent slopes
198	Playco loamy sand, 65 to 90 percent slopes	245	Stahl very gravelly silt loam, tuff substratum, 15 to 30 percent slopes
199	Playco very gravelly loamy sand, tuff substratum, 8 to 30 percent slopes	246	Stahl very gravelly silt loam, tuff substratum, 30 to 65 percent slopes
200	Playco very gravelly loamy sand, tuff substratum, 30 to 65 percent slopes	247	Sulsavar loam, 0 to 8 percent slopes
201	Playco-Rock outcrop complex, 30 to 90 percent slopes	248	Sultan silt loam, 0 to 2 percent slopes
202	Puget silty clay loam, 0 to 2 percent slopes	249	Teneriffe loamy sand, 8 to 30 percent slopes
203	Ragnar loam, 6 to 15 percent slopes	250	Teneriffe loamy sand, 30 to 65 percent slopes
204	Ragnar loam, 15 to 30 percent slopes	251	Teneriffe loamy sand, windswept, 30 to 65 percent slopes
205	Ragnar-Lynnwood complex, 2 to 15 percent slopes	252	Teneriffe very gravelly sandy loam, channery substratum, 8 to 30 percent slopes
206	Ragnar-Lynnwood complex, 30 to 45 percent slopes	253	Teneriffe very gravelly sandy loam, channery substratum, 30 to 65 percent slopes
207	Reggad very cobbly muck, 30 to 90 percent slopes	254	Tokul gravelly loam, 0 to 6 percent slopes
208	Reggad-Haywire complex, 45 to 90 percent slopes	255	Tokul gravelly loam, 6 to 15 percent slopes
209	Reggad-Klapatche-Rock outcrop complex, 45 to 90 percent slopes	256	Tokul gravelly loam, 15 to 30 percent slopes
210	Reggad-Serene complex, 45 to 90 percent slopes	257	Tokul gravelly loam, 30 to 65 percent slopes
211	Reichel silt loam, 6 to 30 percent slopes	258	Tokul-Pastik complex, 45 to 90 percent slopes
212	Reichel silt loam, 30 to 65 percent slopes	259	Trelen loam, 30 to 90 percent slopes
213	Reichel silt loam, tuff substratum, 15 to 30 percent slopes	260	Tukwila muck, 0 to 1 percent slopes
214	Reichel silt loam, tuff substratum, 30 to 65 percent slopes	261	Tusip sandy loam, 15 to 30 percent slopes
215	Riverwash	262	Tusip sandy loam, 30 to 65 percent slopes
216	Rober loam, 0 to 30 percent slopes	263	Typic Haplorthods, 35 to 100 percent slopes
217	Rober loam, 30 to 65 percent slopes	264	Typic Udifluvents, 0 to 3 percent slopes
218	Rock outcrop	265	Typic Udifluvents, windswept, 0 to 3 percent slopes
219	Rock outcrop-Cattcreek complex, 65 to 90 percent slopes	266	Vailton silt loam, 8 to 30 percent slopes
220	Rock outcrop-Cayuse complex, 30 to 90 percent slopes	267	Vailton silt loam, 30 to 65 percent slopes
221	Rock outcrop-Haywire complex, 45 to 90 percent slopes	268	Voight silt loam, 6 to 15 percent slopes
222	Rock outcrop-Rubble land-Haywire complex, 45 to 90 percent slopes	269	Voight silt loam, 15 to 30 percent slopes
223	Rock outcrop-Rubble land-Serene complex, 45 to 90 percent slopes	270	Voight silt loam, 30 to 65 percent slopes
224	Rubble land	271	Welcome loam, 0 to 30 percent slopes
225	Rugles silt loam, 0 to 15 percent slopes	272	Welcome loam, 30 to 65 percent slopes
226	Salal silt loam, 0 to 2 percent slopes	273	Wilkeson gravelly silt loam, 6 to 15 percent slopes
227	Sauk silt loam, 0 to 8 percent slopes	274	Wilkeson gravelly silt loam, 15 to 30 percent slopes
228	Scamman silt loam, 6 to 15 percent slopes	275	Wilkeson gravelly silt loam, 30 to 45 percent slopes
229	Scamman silt loam, 15 to 30 percent slopes	276	Winston loam, 0 to 8 percent slopes
230	Scamman silt loam, 30 to 65 percent slopes	277	Winston loam, 8 to 30 percent slopes
231	Seattle muck, 0 to 1 percent slopes	278	Winston loam, windswept, 0 to 30 percent slopes
232	Serene gravelly sandy loam, 8 to 30 percent slopes	279	Woodinville silt loam, 0 to 2 percent slopes
233	Serene gravelly sandy loam, 30 to 65 percent slopes	280	Zynbar loam, 6 to 30 percent slopes
234	Serene-Rock outcrop complex, 45 to 90 percent slopes	281	Zynbar loam, 30 to 65 percent slopes
235	Shalcar muck, 0 to 1 percent slopes	282	Zynbar silt loam, till substratum, 0 to 15 percent slopes
236	Si silt loam, 0 to 2 percent slopes	283	
237	Skykomish gravelly sandy loam, 0 to 30 percent slopes	284	
238	Skykomish gravelly sandy loam, 30 to 65 percent slopes		
239	Skykomish gravelly sandy loam, windswept, 0 to 30 percent slopes		

CONVENTIONAL AND SPECIAL
SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

National, state, or province

County or parish

Minor civil division

Reservation (national forest or park, state forest or park, and large airport)

Land grant

Limit of soil survey (label)

Field sheet matchline and neatline

AD HOC BOUNDARY (label)

Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNER
(sections and land grants)

ROADS

Divided (median shown if scale permits)

Other roads

Trail

ROAD EMBLEM & DESIGNATIONS

Interstate

Federal

State

County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE
(normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

Without road

With road

With railroad

DAMS

Large (to scale)

Medium or Small

PITS

Gravel pit

Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban area)

Church

School

Indian mound (label)

Located object (label)

Tank (label)

Wells, oil or gas

Windmill

Kitchen midden

WATER FEATURES

DRAINAGE

Perennial, double line

Perennial, single line

Intermittent

Drainage end

Canals or ditches

Double-line (label)

Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

Perennial

Intermittent

MISCELLANEOUS WATER FEATURES

Marsh or swamp

Spring

Well, artesian

Well, irrigation

Wet spot

SPECIAL SYMBOLS FOR
SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

Bedrock (points down slope)

Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

Blowout

Clay spot

Gravelly spot

Gumbo, slick or scabby spot (sodic)

Dumps and other similar non soil areas

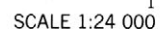
Prominent hill or peak

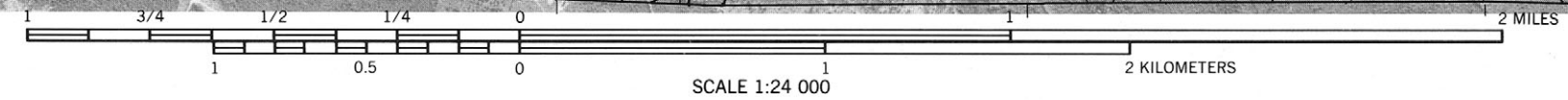
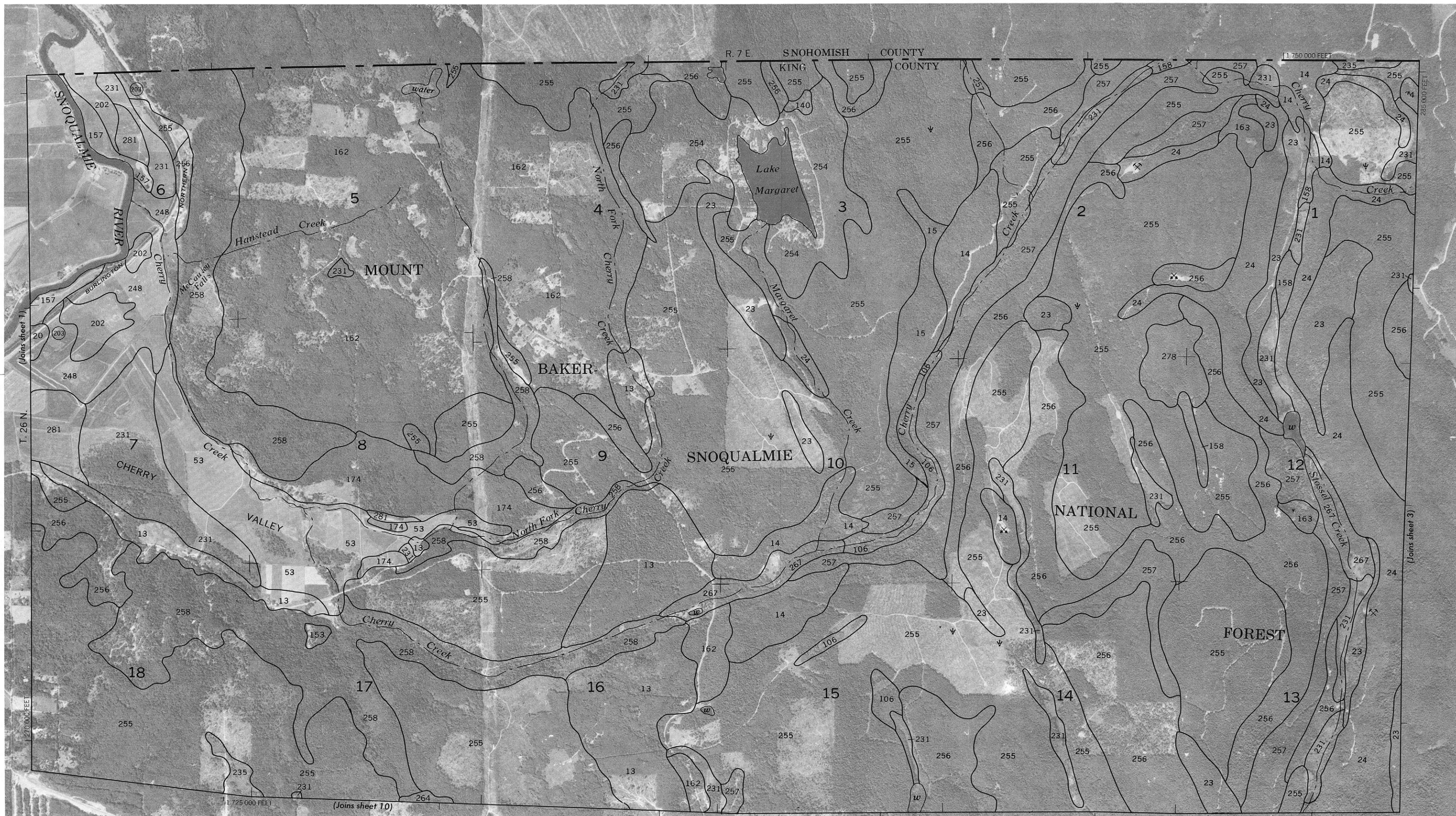
Rock outcrop (includes sandstone and shale)

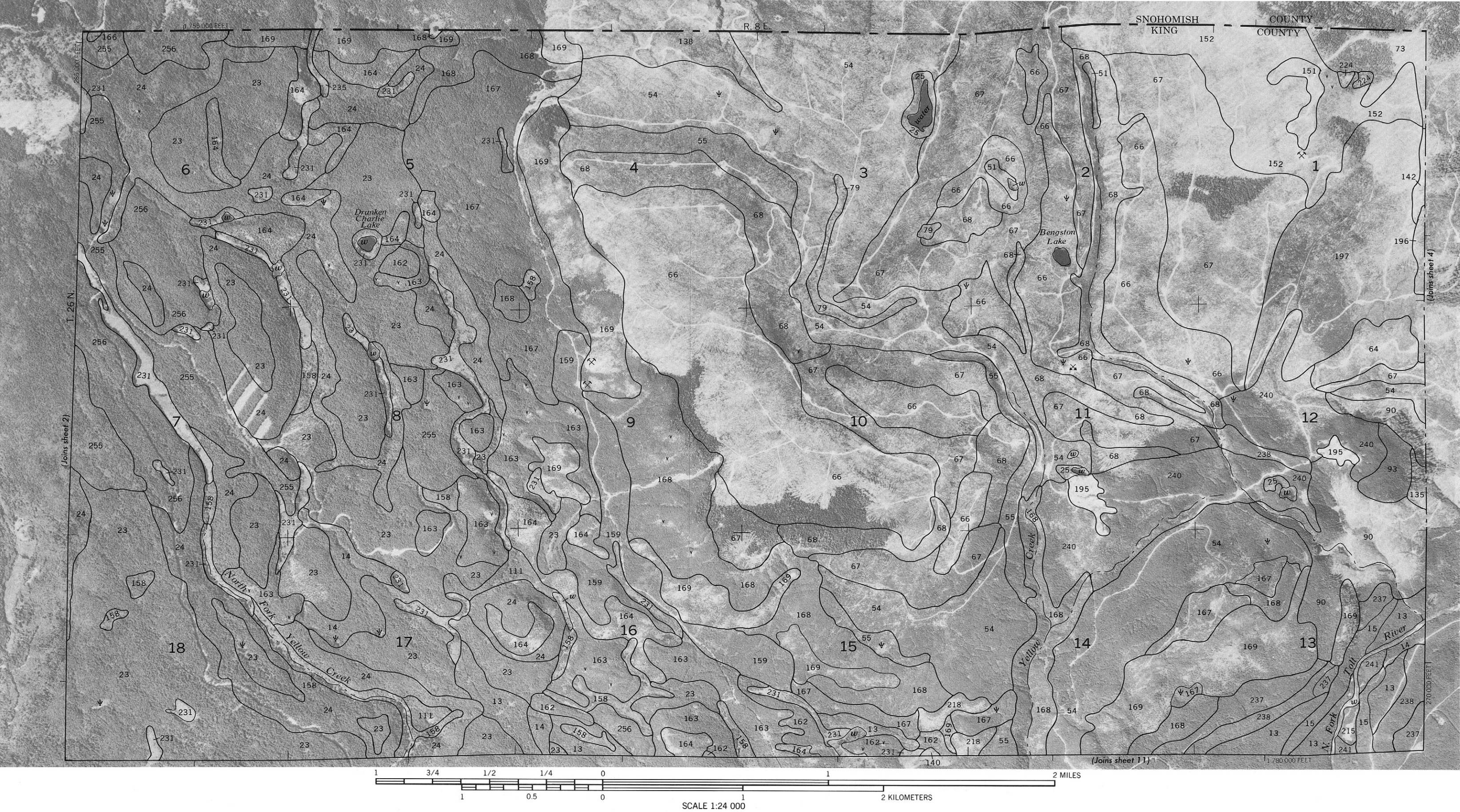
Saline spot

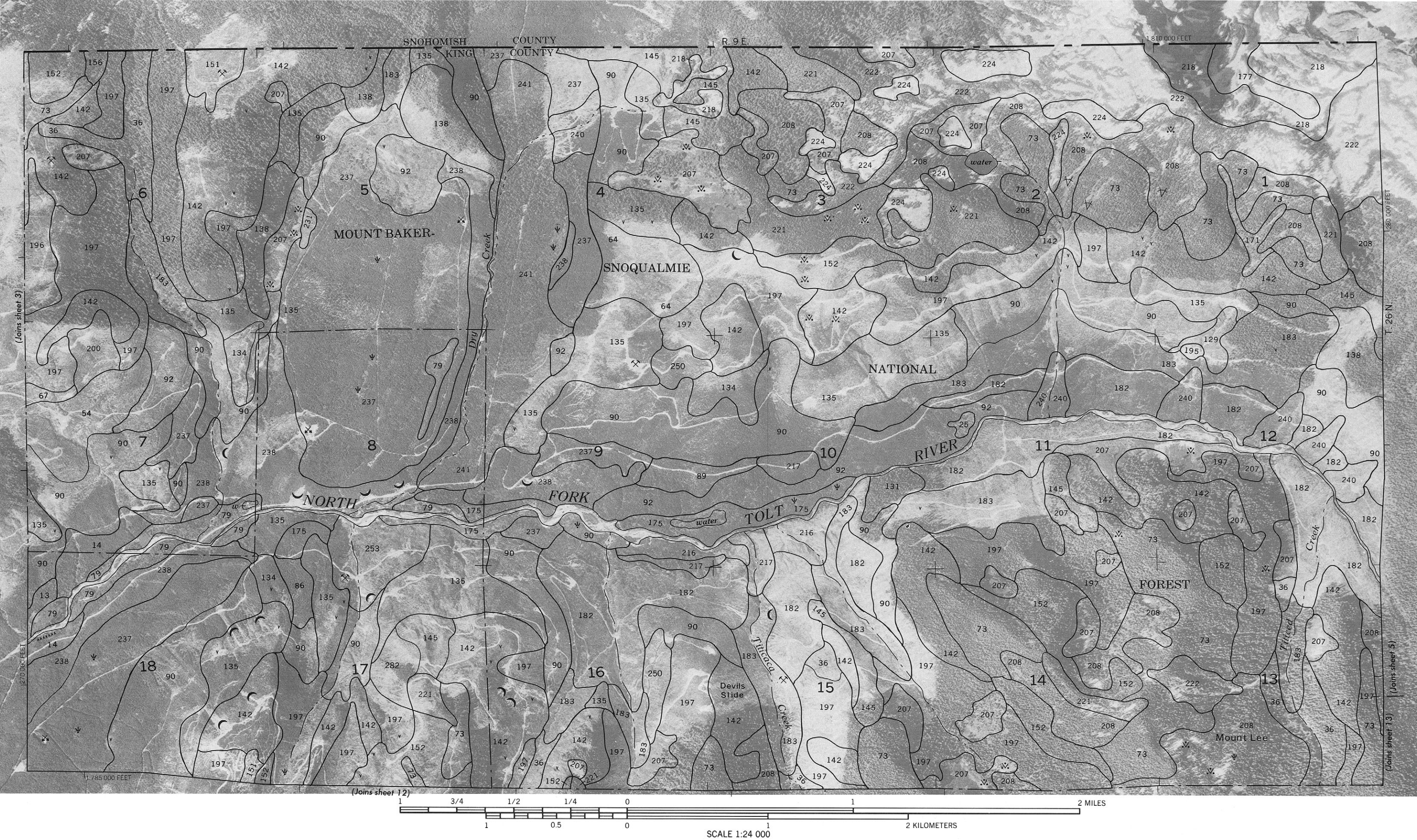
Sandy spot

Severely eroded spot

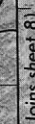


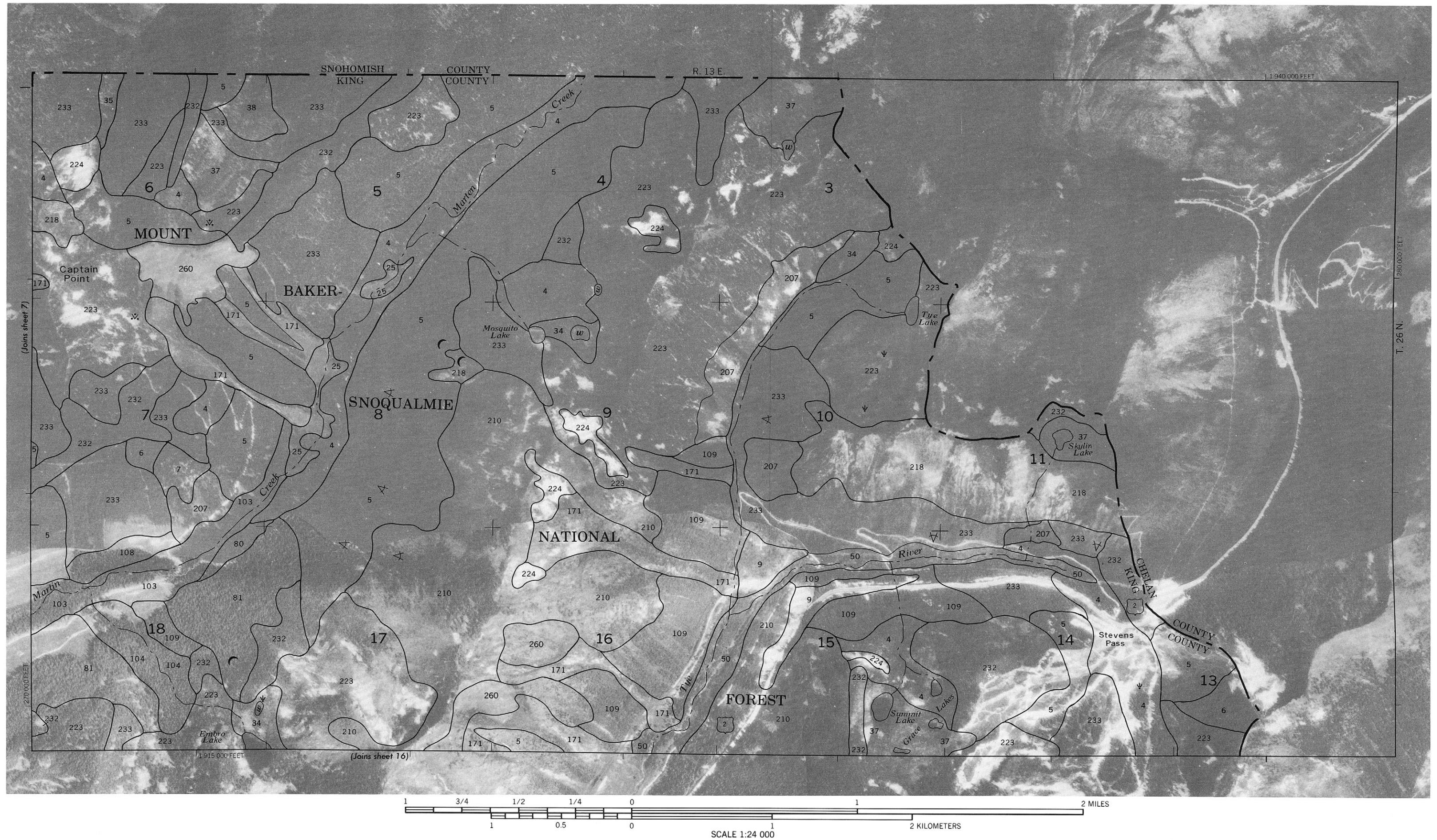


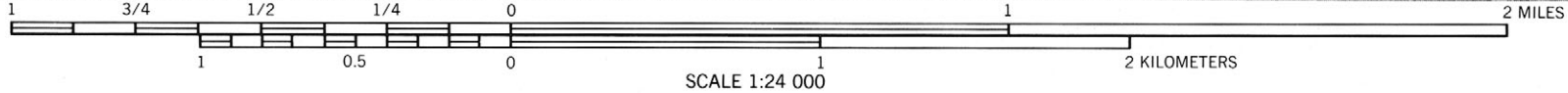


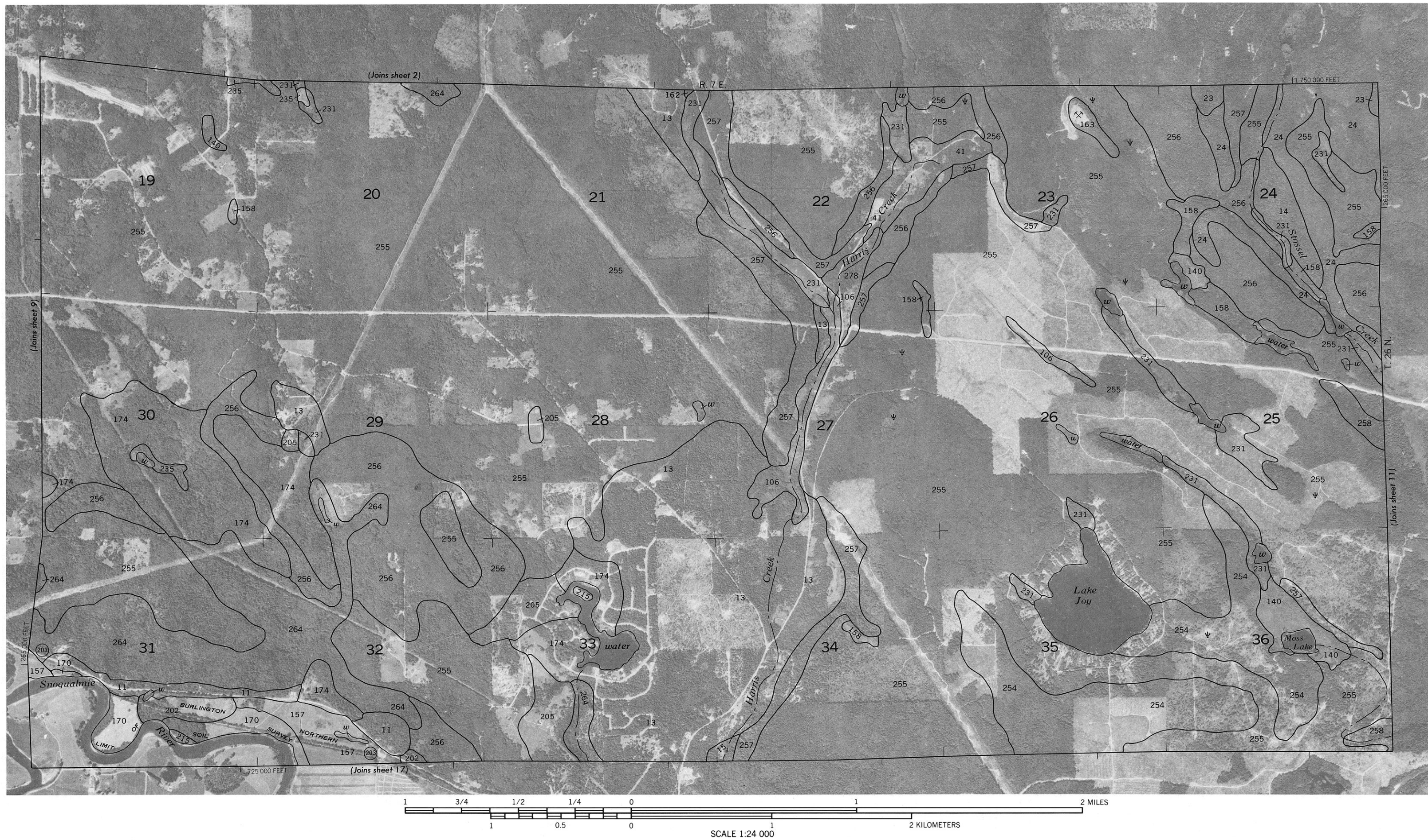


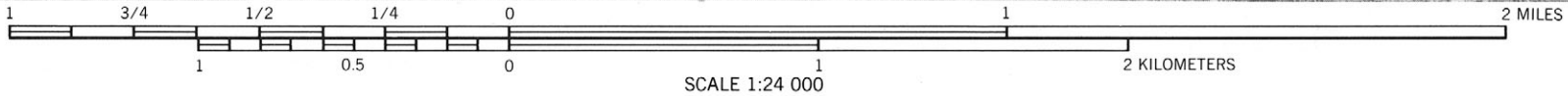
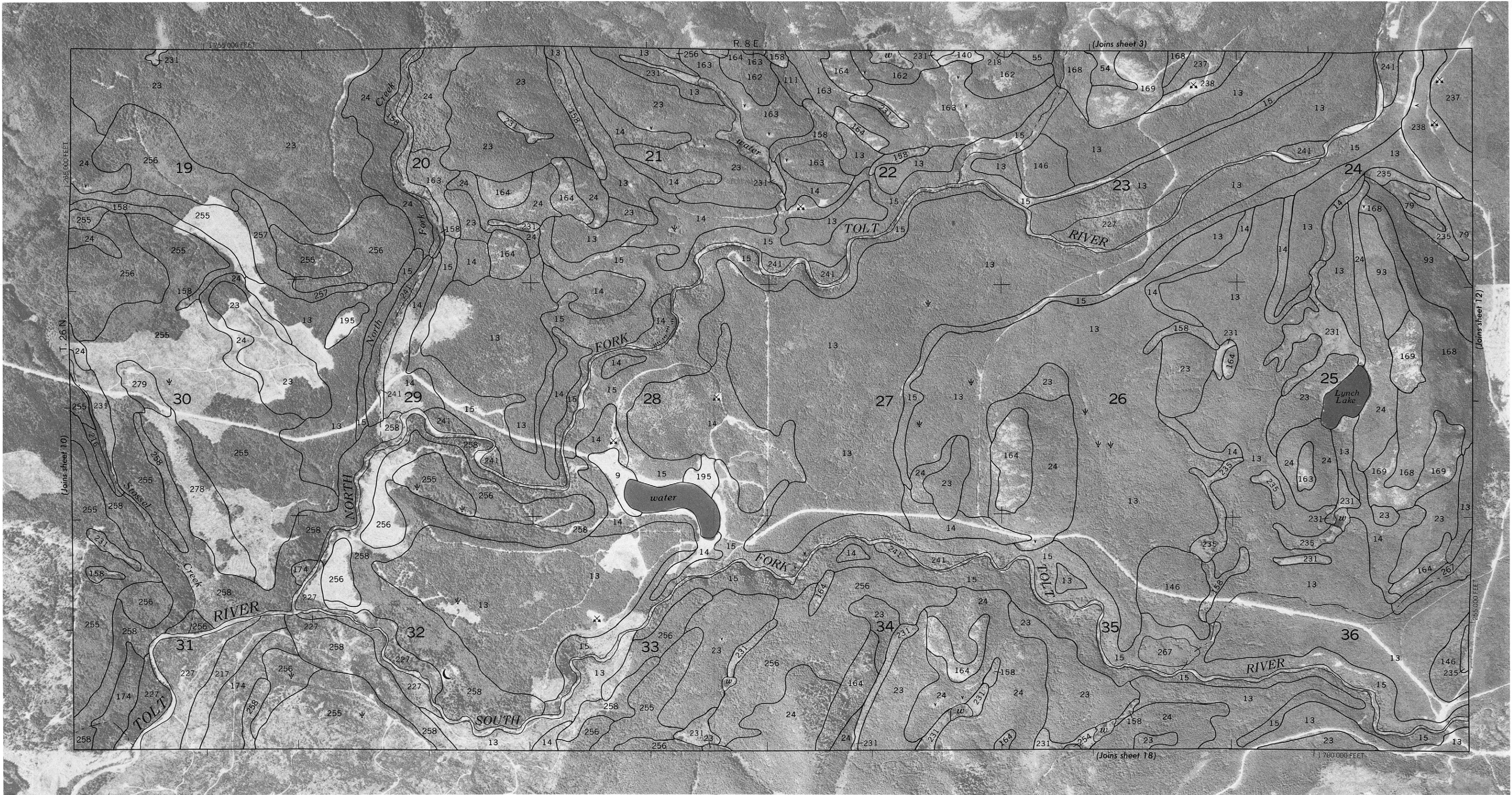


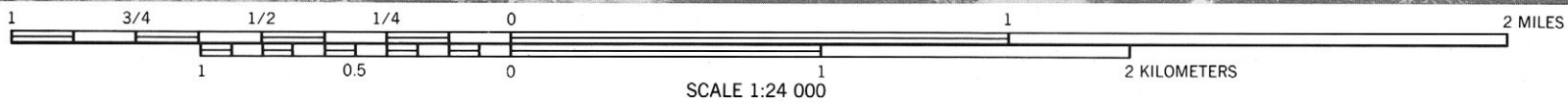


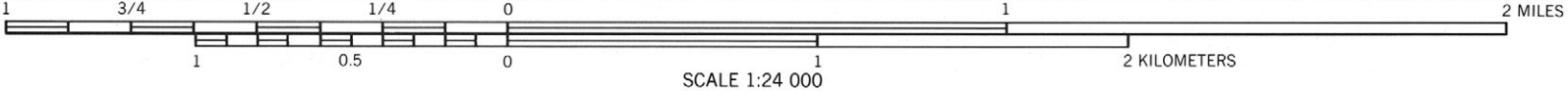
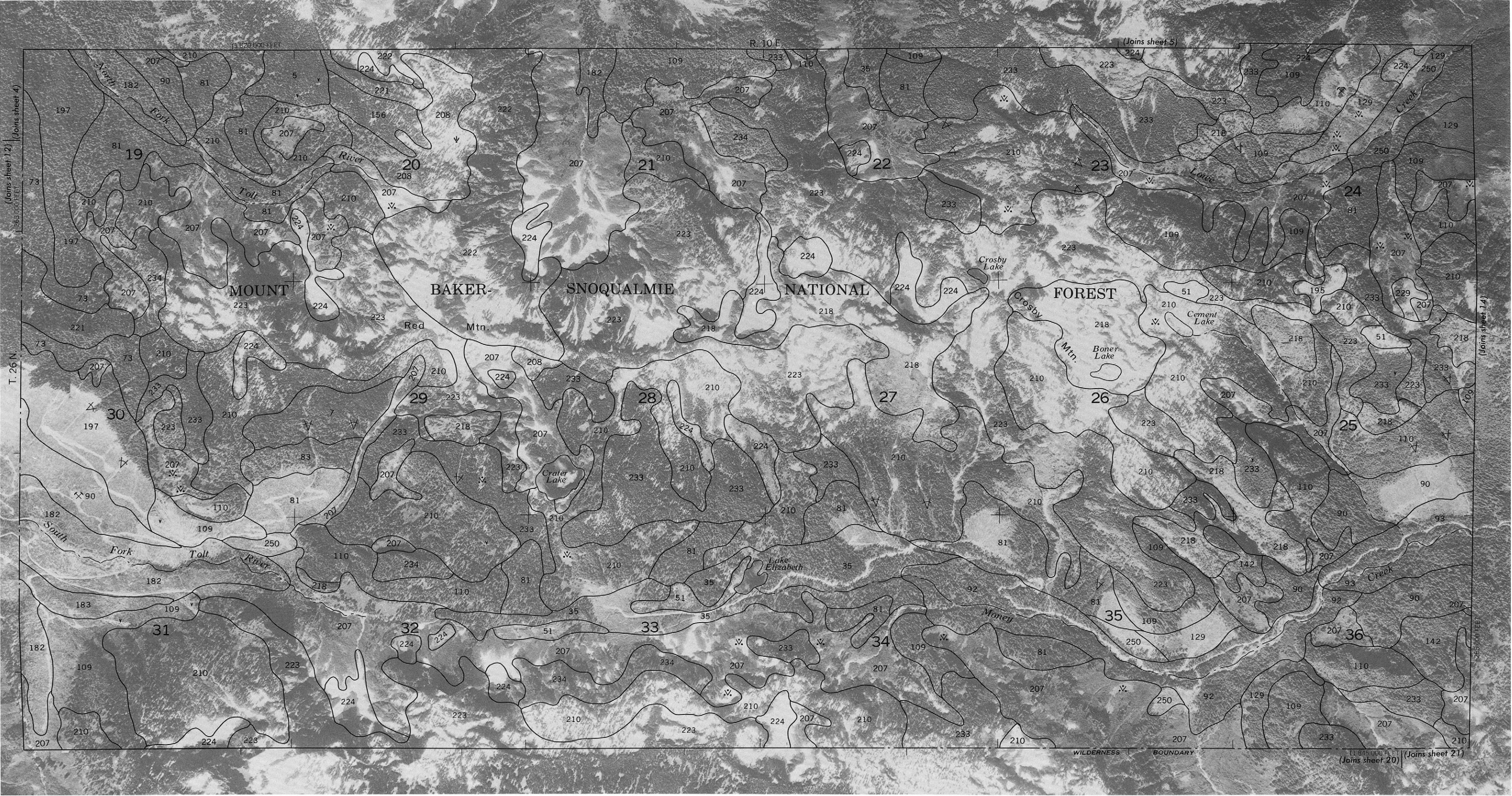


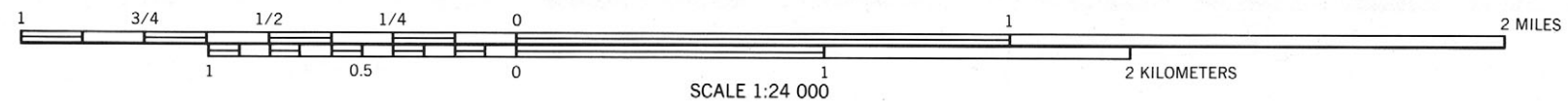


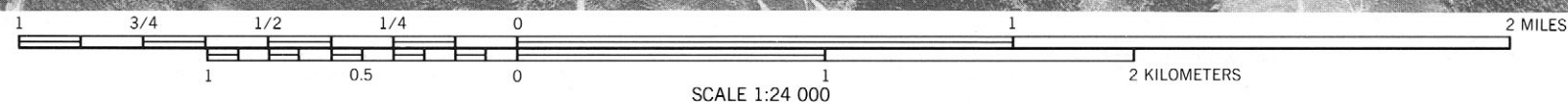


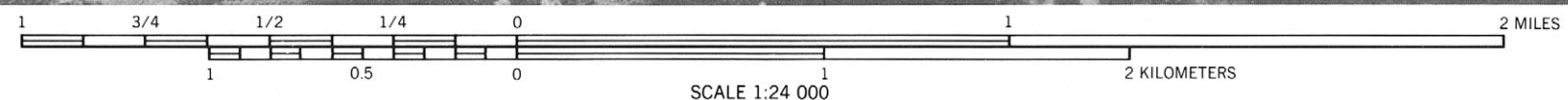




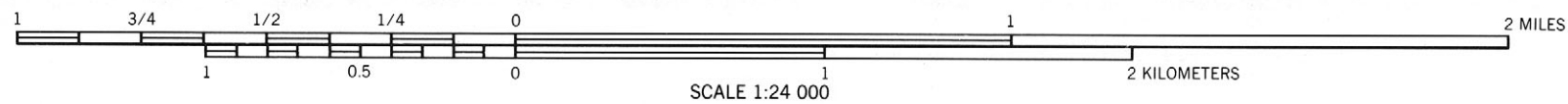


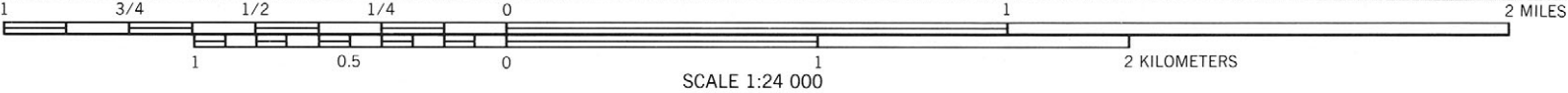
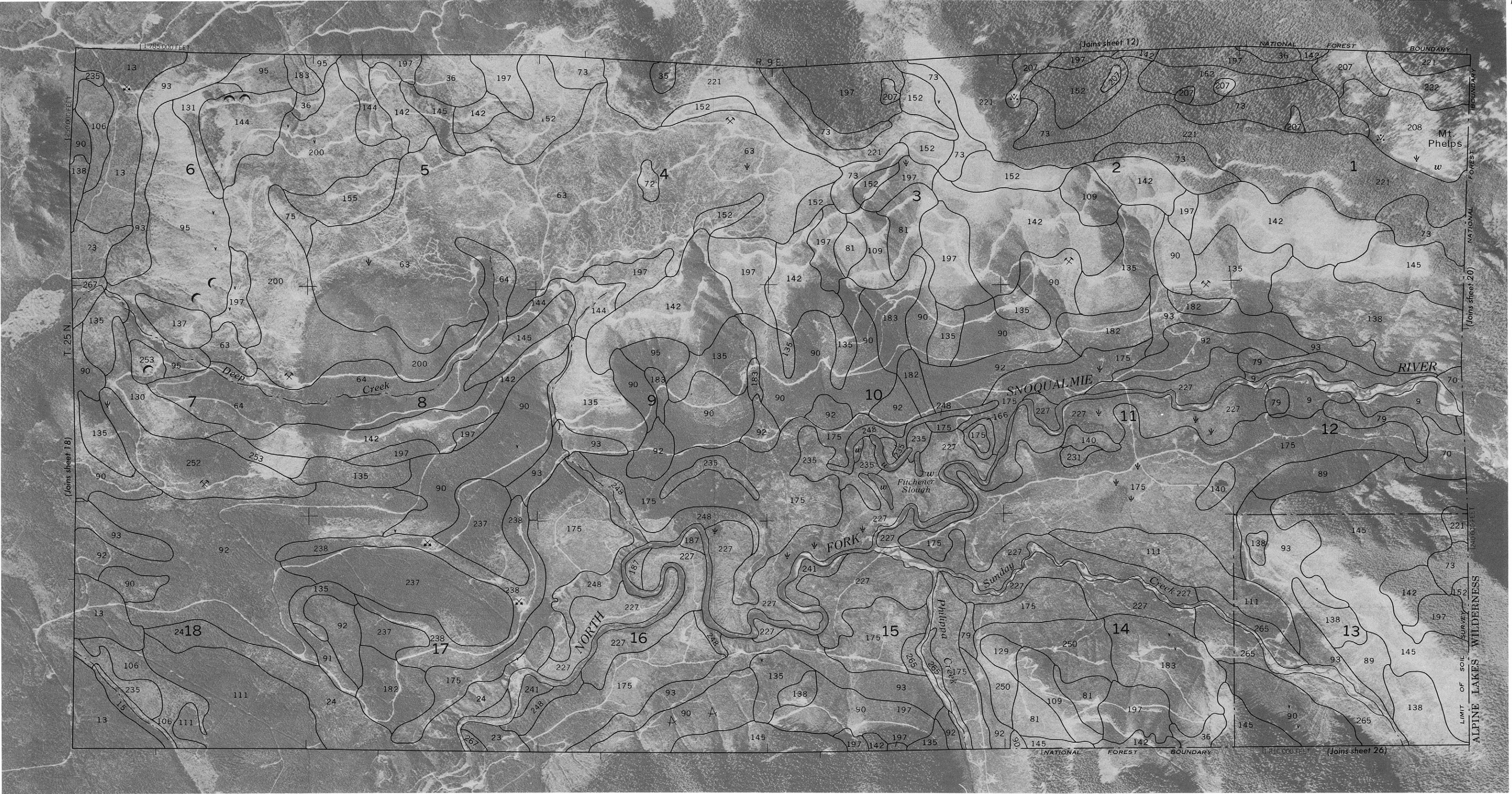


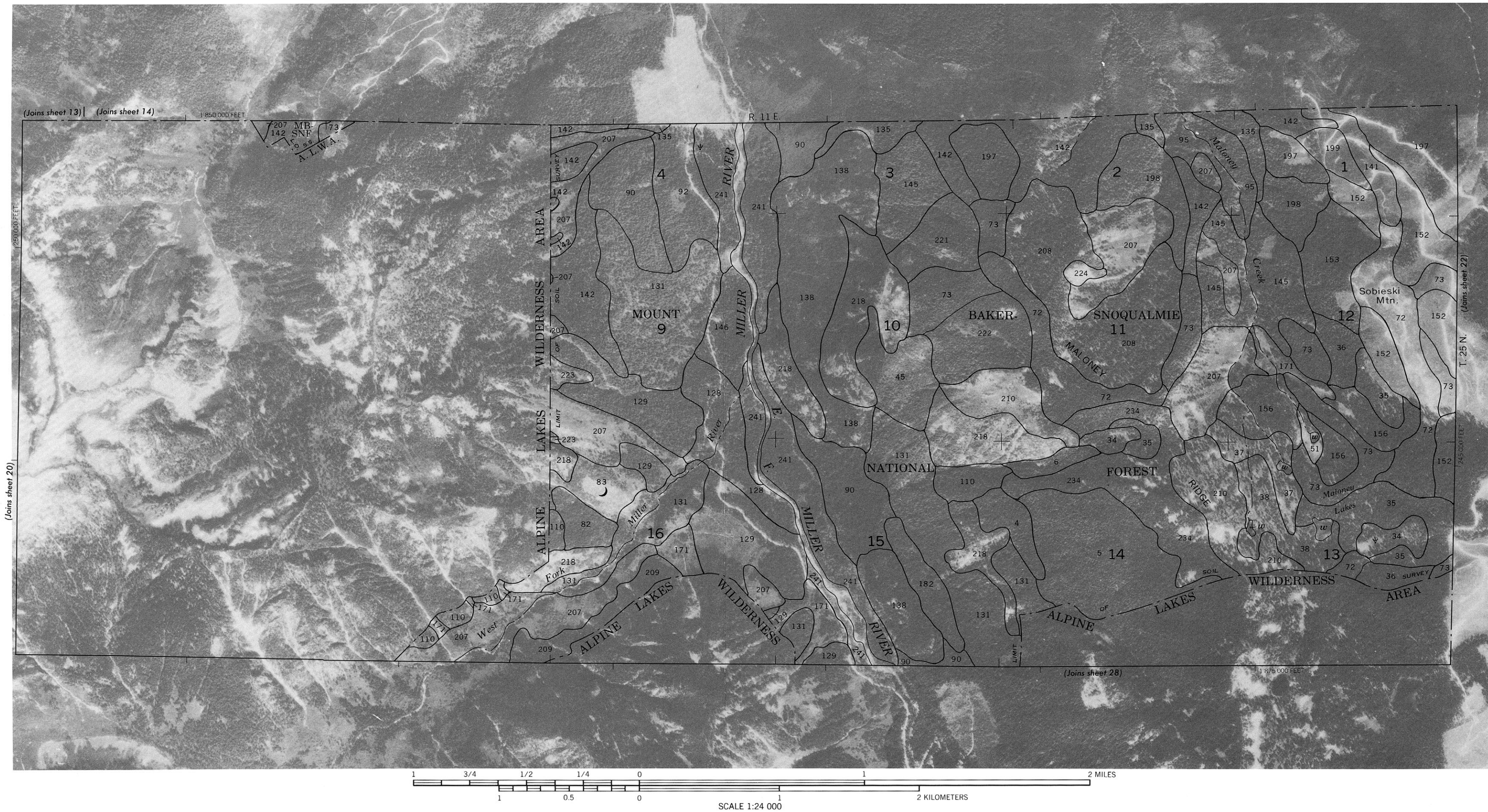


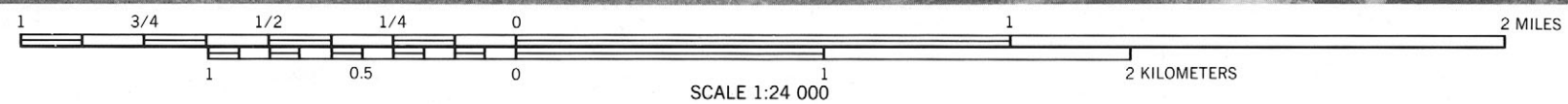


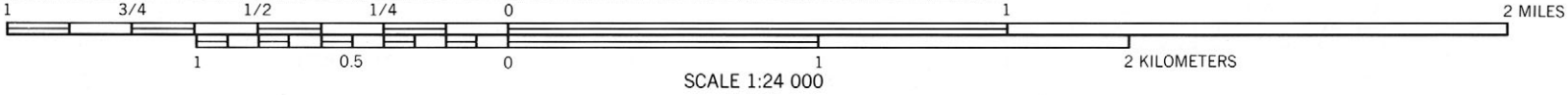
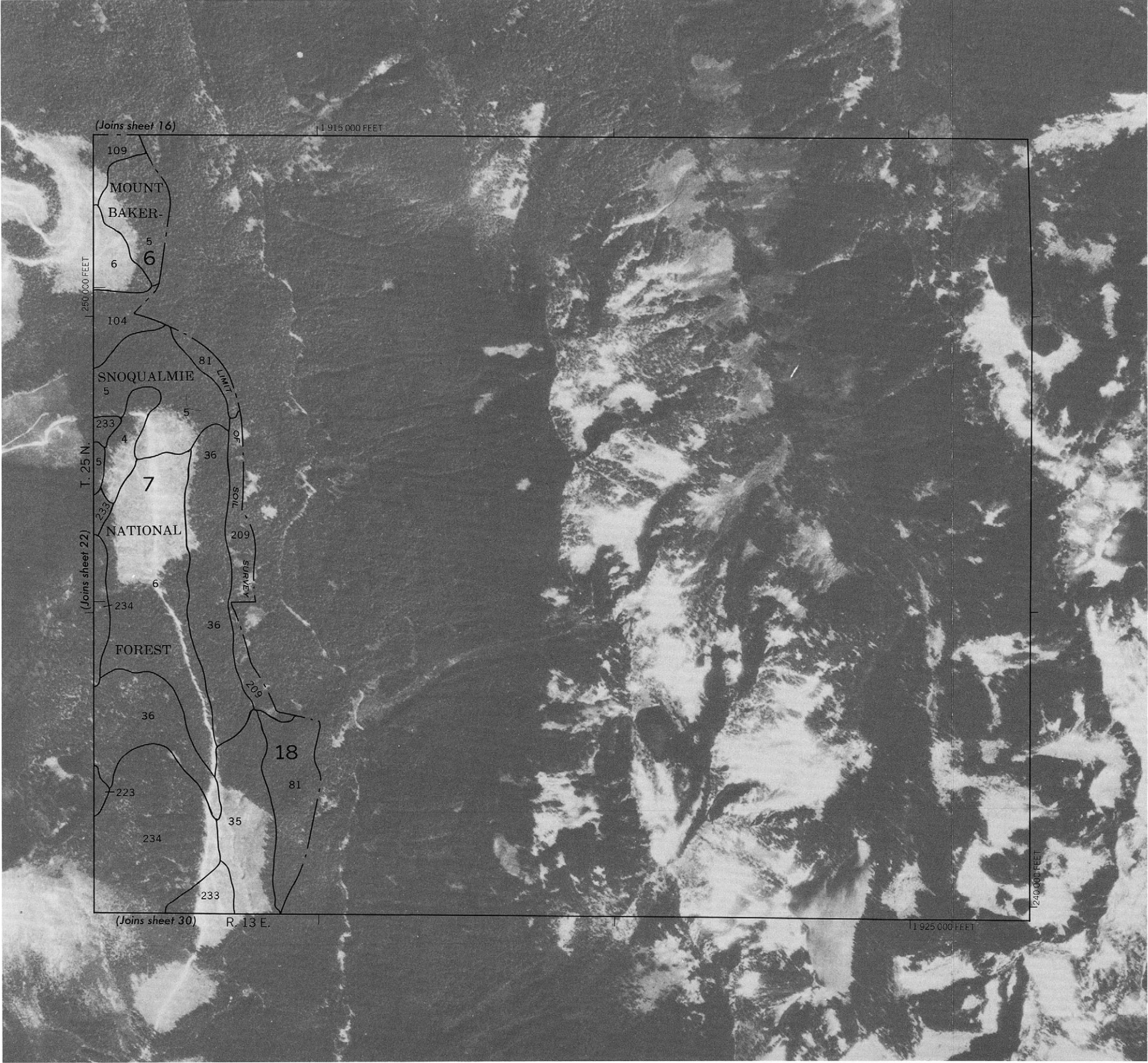


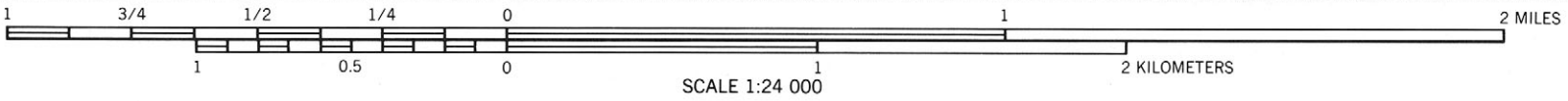


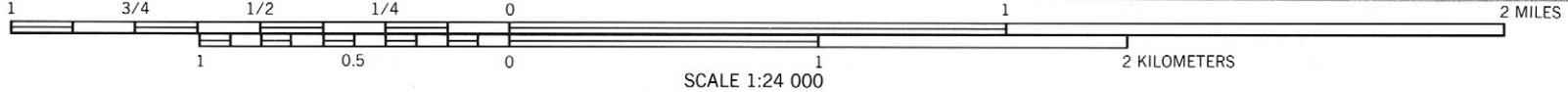


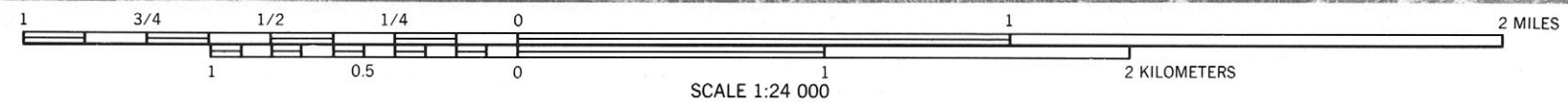
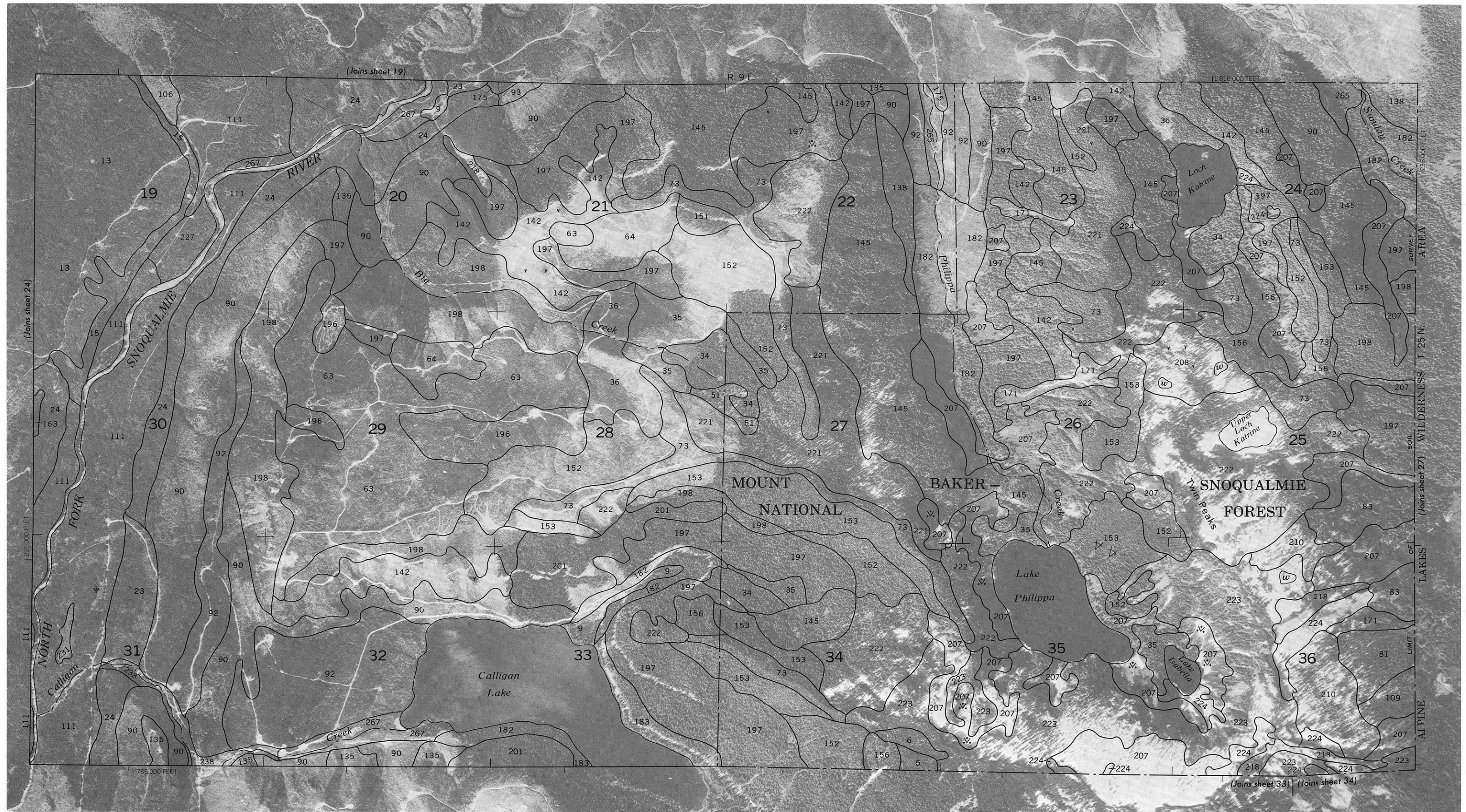


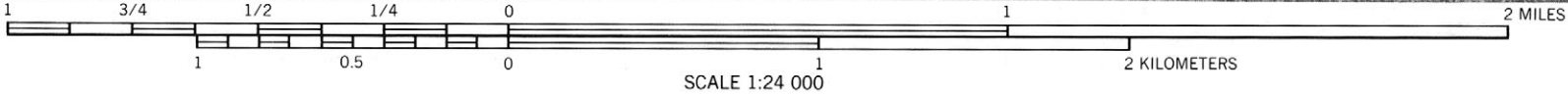


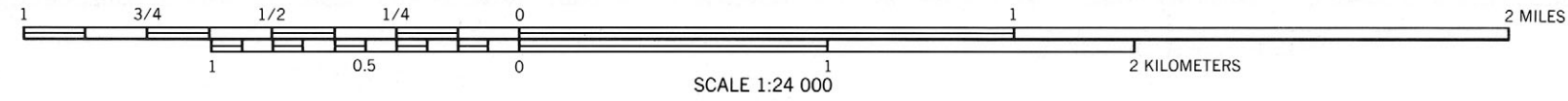
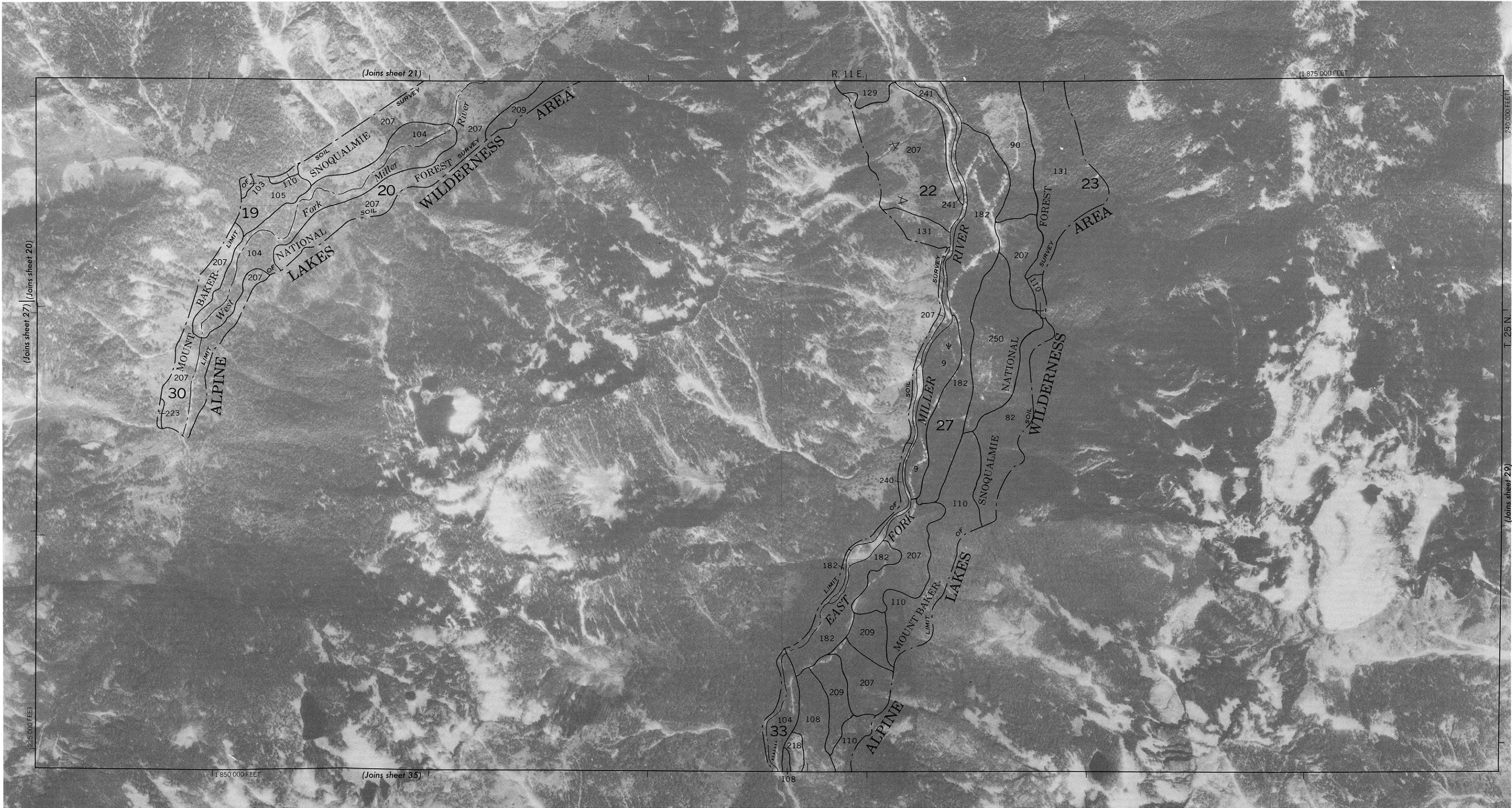


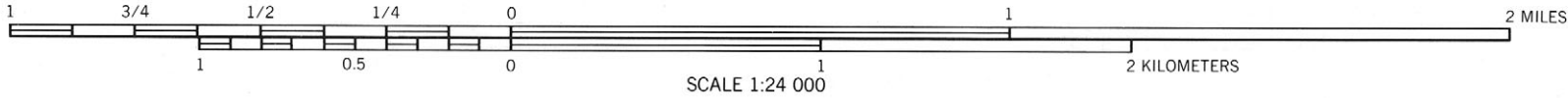
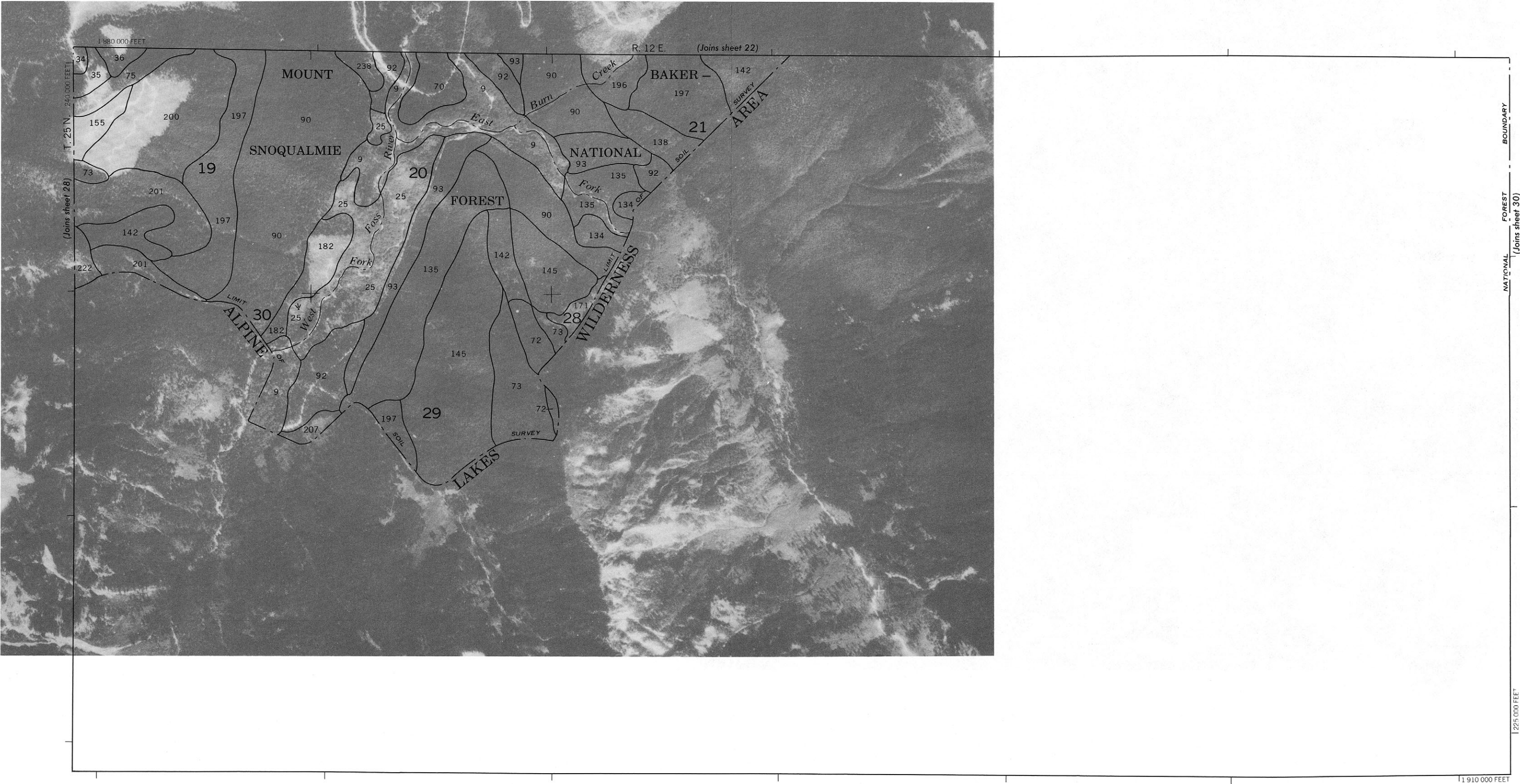


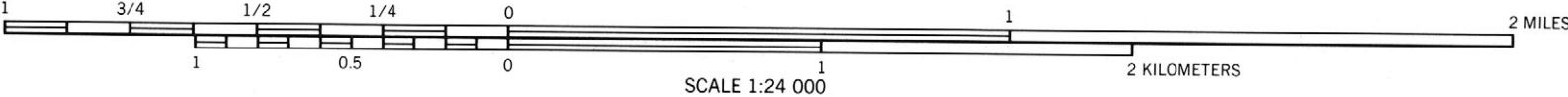














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